IMPACT OF SENSORY INTEGRATION ON SLEEP DISTURBANCE AMONG CHILDREN WITH SENSORY PROCESSING DISORDER

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Certificate

CERTIFICATE

This is to certify that the research work entitled **IMPACT OF SENSORY INTEGRATION ON SLEEP DISTURBANCE AMONG CHILDREN WITH SENSORY PROCESSING DISORDER** was carried out by Reg. No.411513001 , KMCH College of Occupational Therapy, towards partial fulfillment of the requirements of Master of Occupational Therapy (Advanced OT in Pediatrics) of the Tamil Nadu Dr. M.G.R. Medical University, Chennai.

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ABSTRACT

1. ABSTRACT

Aim

To find the impact of Sensory integration on sleep disturbance among children with sensory processing disorder.

Methods

This study was done to find the impact of sensory integration on sleep disturbance among children with sensory processing disorder and for this purpose 20 SPD children with sleep disturbance were assigned according to convenience into the experimental and control group. There were 8 males and 2 girls in the experimental group and 8 boys and 2 girls in the control group. Dunn's sensory profile was used to measure sensory issues, Children sleep habit questionnaire to measure sleep disturbance and Visual Analogue Scale to measure child sleep quality and parents satisfaction.

Results

Pre test score in experimental group in CSHQ had a mean value of 56.10, and control group had 56.70. The post test results of the experimental group had a mean value of 37.90 and the control group had 55.70. Post test of experimental group with a value of 0.005 (<0.05) indicating reduction in sleep disturbances. Pre test score in experimental group had a mean value of 45 n VAS, and control group had 44. The post test results of the experimental group had a mean value of 80 and the control group had 47. Post test of experimental group with a value of 0.004 (<0.05) indicating improvement in children sleep quality. Pre test score in experimental group had a mean value of 52 in VAS, and control group had 46. The post test results of the experimental group had a mean value of 84 and the control group had 49. Post test of experimental group with a value of 0.004 (<0.05) indicating increase in parents satisfaction. There is significant difference in sensory processing skill as measured by sensory profile in experimental group.

Conclusion This can be summarized by the findings which prove that the sensory integration for child with sleep disturbance in experimental group varied from child with sleep disturbance of control group by showing a little improvement in their sleep quality.

INTRODUCTION

INTRODUCTION

Sleep is naturally recurring state of mind and body, characterized by altered consciousness, relatively inhibited sensory activity, inhibition of nearly all voluntary muscles , and reduced interaction with surrounding .

Sleep is a vital function for all living creatures; not merely a state of shut-down, but as a state of activity that serves to facilitate maturation, reorganization, and restoration. From an onto genic perspective, sleep pattern vary throughout development will more sleep needed during critical periods of brain growth.[1]

During the first 2 years of life, children spend more hours asleep than awake[2] and it is during this period of time in early childhood that neurological connections are formed in the central nervous system, providing the foundation for all future cognitive, sensory-motor, and social emotional development. As such, from an evolutionary perspective, sleep has not only retained its status as a vital occupation but has proven to be critical in the establishment of all other areas of development[2].

According to Hirshkowitz (2004),sleep is a brain process similar to other homeostatic processes such as thirst or hunger. Influenced by a circadian rhythm, sleep consists of two main stages: rapid eye movement (REM) sleep and non- REM sleep[2]. Although the reasons for sleep are not fully clear, it is known that sleep is essential to our health and survival .

Sleep quality can influence observable behaviors in children such as attention, cognitive performance, motor coordination, and certain aspects of executive functioning and children with behavioral and psychological disorders have higher rates of sleep problems[2].Sleep impacts every aspect of child development, including learning, processing and remembering information.

Adequate amount of sleep is very much essential for the optimal growth and development of children. Lack of sufficient sleep has a myriad of negative consequences for a typical child, such as clumsiness and impaired attention to task .

Lack of sleep can also prevent a child from paying attention in school or focusing on learning. Further, a child's mood and behaviour are affected by a lack of sleep[4].Other aspects of development impacted by insufficient sleep include growth (i.e., growth hormone is released during sleep for young children), obesity (insufficient sleep causes weight gain)

and health. In particular, a child's immune system can weaken without enough sleep. A weakened immunes system can affect a child's ability to fight off a cold and stay healthy.

Chronically disrupted sleep can lead to problems in cognitive functioning including memory, attention, and abstract complex tasks .Significant behaviour, mood, and performance impairments have also been documented.

The vast majority of children will have difficulty falling or staying asleep. Temporary sleep difficulties are normal. However, studies have shown that significant sleep problems occur in 40%-80% of children with autism. Sleep monitoring studies have shown that children with autism take longer to fall asleep, are awake for longer in the middle of the night, and sleep for shorter periods than typically developing children.

It is extremely common for children with ASD to have difficulty getting to sleep, sleeping for a few hours at a time, and/or staying asleep without frequently waking throughout the night. These poor sleep habits are easily created and can be extremely difficult to change.

Mayes and Calhoun (2009) found that sleep problems increased with severity of autism symptoms, and suggested that sleep disturbance is part of the overall autism symptom complex. Children on the autism spectrum (ASD) appear to experience these sleep disturbances more frequently and intensely than typically developing children.

It has also been found that sleep problems persist through adolescence in those with autism. For children with autism, insufficient sleep appears to impact daytime behaviours, making challenging behaviours worse. Sleep disturbance has also been shown to worsen symptoms such as hyperactivity and obsessive and ritualistic behaviours.

Sensory processing is a neurological process that organizes sensation form one's body and the environment and makes it possible to use the body effectively within the environment. It is information processing.[4] *Sensory Processing Disorder (SPD, formerly known as "sensory integration* dysfunction") is a condition that exists when sensory signals *don't get organized* into appropriate responses. A. Jean Ayres, PhD, likened SPD to a neurological "traffic jam" that prevents certain parts of the brain from receiving the information needed to interpret sensory information correctly.

According to an article published by university of California San Francisco (2013), Sensory processing disorders affect 5 to 16 percent of school-aged children. Sensory processing

disorders (SPD) are more prevalent in children with autism than attention deficit hyperactivity disorder, yet the condition receives far less attention partly because it's never been recognized as a distinct disease.[5]

Sensitivity to sensory stimuli has been suggested as a contributing factor to sleep problems [9,11,13,14]. Both sleep and sensory modulation have been linked to overall arousal and release of the stress hormone cortisol[10,12,14]

Existing evidence on the relationship between sleep and sensory processing characteristics currently spans ages 3 to 61 yr. These studies have included children with fetal alcohol spectrum disorder[9], autism spectrum disorder[10], and atopic dermatitis[11]; healthy school-age children and children with attention deficit hyperactivity disorder[12]; healthy adults[13]; and adults with sleeping problems[14].

Findings demonstrate that different ways of attending to sensory experiences, particularly increased sensitivity, are correlated with reductions in sleep quality [10,11,12,13]

In addition, sensory processing patterns involving avoiding sensations[11,13], seeking out sensations[13], and not registering environmental stimuli[15], have been associated with changes in sleep quality. Although issues with sleep have been identified in children with sensory processing difficulties[16], the association of sensory processing patterns with sleep in infants and toddlers aged 0–36 mo is largely unknown.

Need of the study

- Stacey Reynolds, Shelly J. Lane, Leroy Thacker (2011) Sleep problems have been frequently identified in children with autism spectrum disorders .
- Though few studies had reported relationship between sensory processing disorder , sensory sensitivity and sleep disturbance , these studies are not adequate report to generalize the relationship between SPD and sleep problems
- Meryl Marger Picard, MSW, OTR (2012) developed a study to study the effectiveness of intervention on individuals with sleep disturbance. She suggested that cognitive or behavioural therapy interventions, or sensory integration strategies are used to address sleep disturbances.

- Behavior intervention had already proven to be effective for sleep problems Jennifer (L penny v PHD. 2011)
- Meryl suggest no studies have been conducted to examine the influences of sensory – based OT such as SI intervention on sleep behavior.
- No research evidence for effectiveness of SI among SPD's with sleep disturbance .
- To address the limitation of most of the studies there is need for research especially in children with sleep disturbance.

Research question

- Will Sensory integration therapy improve sleep quality in children with Sensory Processing Disorder?

AIM AND OBJECTIVES

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Aim

- To find the impact of Sensory integration on sleep disturbance among children with sensory processing disorder.

Objectives:

- To evaluate the effectiveness of sensory integration therapy on sleep disturbance among children with SPD.
- To compare the effectiveness of sensory integration therapy with sleep schedule for sleep disturbance in children with SPD.

OPERATIONAL DEFINITIONS

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- Sensory processing disorder (SPD): A neurophysiologic condition in which sensory input either from the environment or from one's body is poorly detected, modulated, or interpreted and/or to which atypical responses are observed. (Miller 2013)

- Sleep disturbance: Sleep disturbances encompass disorders of initiating and maintaining sleep (DIMS, insomnias), disorders of excessive somnolence (DOES), disorders of sleep–wake schedule, and dysfunctions associated with sleep, sleep stages, or partial arousals (parasomnias).

- Sensory Integration intervention: Aims to provide the child with various sensory experiences.
- Sleep schedule: It will facilitate few adjustments to child daily routine and can help child go to bed and wake up at the same time every day.

HYPOTHESIS

HYPOTHESIS

Alternate Hypothesis:

Sensory integration therapy is effective in decreasing sleep disturbance among children with SPD.

Null Hypothesis: Sensory integration therapy is not effective in decreasing sleep disturbance among children with SPD.

RELATED LITERATURE

RELATED LITERATURE

A child does not passively absorb whatever sensations come along. Rather the child selects those sensations that are most useful at the time and organizes them in a fashion that facilitates accomplishing goals. This is the process of sensory integration. When this process is going well, the child organizes a successful, goal directed action on the environment, which is called an adaptive response. When a child makes an adaptive response, he or she successfully meets some challenge presented in the environment. The adaptive response is possible because the brain has been able to efficiently organize incoming sensory information, which then provide basis for action[13].

Definition of sensory processing disorder

The term ***sensory integration dysfunction*** was first used by Ayres in 1963[14]. On the basis of knowledge of neural science and detailed observation of child behaviour, Ayres theorized that impaired sensory processing might result in various functional problems, which she labelled *sensory integrationdysfunction*[15].

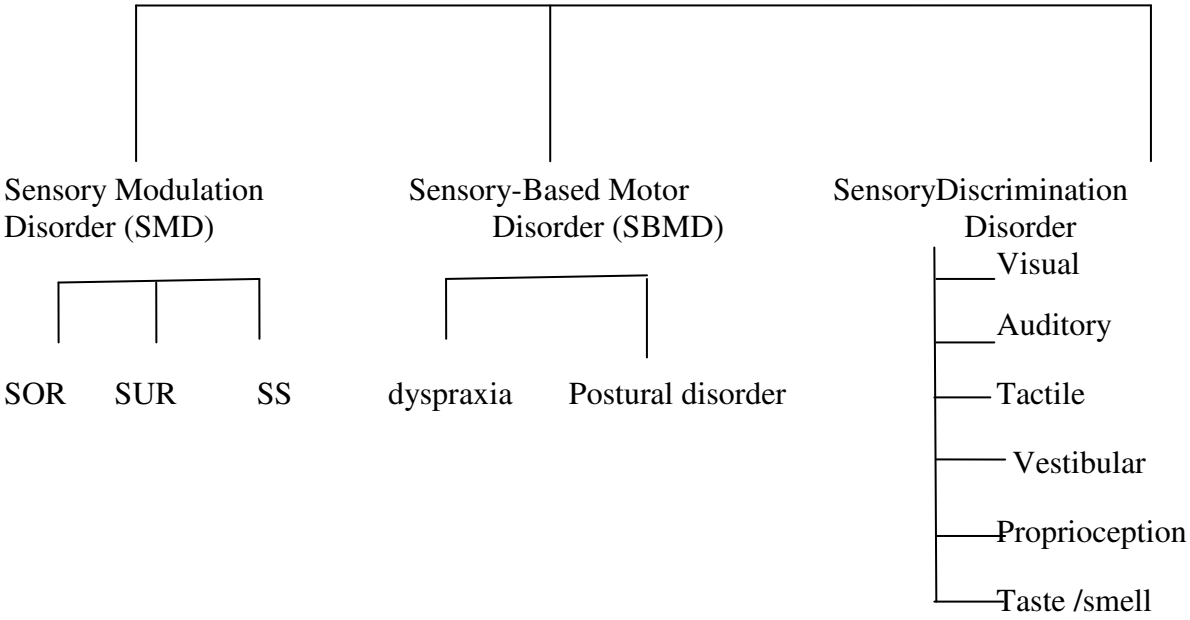
Sensory processing disorder is a neurophysiologic condition in which sensory input either from the environment or from one's body is poorly detected, modulated, or interpreted and/or to which atypical responses are observed[5].

Indicators of SPD include inappropriate or problematic motor, behavioral, attentional,or adaptive responses following or anticipating sensory stimulation. Sensory differences are only considered a "disorder" when they cause significant difficulties with daily routines and tasks (e.g. individual can't cope or compensate)[5].

Nosology of Sensory Processing Disorder

According to the new nosology of sensory processing disorder by Miller(2007), it is divided into Sensory Modulation Disorder (SMD), Sensory Based Motor Disorder and Sensory Discrimination disorder. Sensory modulation disorder is again classified into Sensory Under Responsivity(SUR) , Sensory Over Responsivity(SUR), Sensory Seeking(SS). Semsory based motor disorder as dyspraxia and postural disorder; Sensory discrimination disorder into visual, auditory, tactile, vestibular, proprioception and taste/smell.

SENSORY PROCESSING DISORDER (SPD)



OR=Sensory Over-Responsivity

SUR=sensory UnderResponsivity

SS=Sensory Seeker/Craver

Sensory Modulation Disorder (SMD)

Sensory modulation occurs as the centralnervous system regulates the neural messagesabout sensory stimuli. SMD resultswhen a person has difficulty responding tosensory input with behavior that is gradedrelative to the degree, nature, or intensity ofthe sensory information.

SMD Subtype 1: Sensory Overresponsivity (SOR):

People with SOR respond to sensation faster, with more intensity, or for a longer duration than those with typical sensory responsivity. Over responsivity may occur in only one sensory system (e.g., tactile defensiveness) or in multiple sensory systems (e.g., sensory defensiveness).

SMD Subtype 2: Sensory Under responsivity (SUR):

People with SUR disregard, or do not respond to, sensory stimuli in their environments. They appear not to detect incoming sensory information. This lack of initial awareness may lead to apathy, lethargy, and a seeming lack of inner drive, to initiate socialization and exploration.

SMD Subtype 3: Sensory Seeking/ Craving (SS):

People with SS crave an unusual amount or type of sensory input and seem to have an insatiable desire for sensation. They energetically engage inactions that add more intense sensations to their bodies in many modalities (e.g., spicy food, loud noises, visually stimulating objects, constant spinning).

Sensory-Based Motor Disorder (SBMD)

People with SBMD have poor postural or volitional movement as a result of sensory problems. The two subtypes of SBMD are detailed below.

SBMD Subtype 1: Postural Disorder.

Postural disorder (PD) is difficulty stabilizing the body during movement or at rest to meet the demands of the environment or of a given motor task. PD is characterized by inappropriate muscle tension, hypotonic or hypertonic muscle tone, inadequate control of movement, or inadequate muscle contraction to achieve movement against resistance. Poor balance between flexion and extension of body parts, poor stability, poor righting and equilibrium reactions, poor weight shifting and trunk rotation, and poor ocular–motor control also may be noted.

SBMD Subtype 2: Dyspraxia.

Dyspraxia is an impaired ability to conceive of, plan,sequence, or execute novel actions. Peopleappear awkward and poorly coordinated ingross, fine, or oral–motor areas.

Sensory Discrimination Disorder (SDD)

People with SDD have difficulty interpreting qualities of sensory stimuli and are unable to perceive similarities and differences among stimuli. They can perceive that stimuli are present and can regulate their response to stimuli but cannot tell precisely what or where the stimulus is. SDD can be observed in any sensory modality. A person with SDD may have different capacities in each modality (e.g., a visual or auditory discrimination disorder but good discrimination in all other modalities)[15].

Dunn's model of sensory processing:

Dunn[16,17] presented conceptual model that takes into account the potential roles of various neural processes in generating patterns of under-responsiveness and over responsiveness.

	Responding / Self Regulation Strategies	
Thresholds/Reactivity	Passive	Active
High	Low registration Seeking	Sensory
Low	Sensory sensitivity	Sensory Avoiding

In her model, four main patterns represent individual differences in sensory responding: low registration, sensation seeking, sensitivity to stimuli and sensation avoiding. These patterns are hypothesized to emerge from individual differences in the neural processes of habituation, sensitization, threshold, and maintenance of homeostasis.

The person who falls in the low registration quadrant of the model is under responsive due to high threshold for reactivity and therefore needs to have a high level of intensity in environmental stimuli in order to notice and attend.

The person who falls in the sensation seeking quadrant is also considered under responsive with regard to high threshold but expresses this behaviourally by active seeking out intense sensory input. The sensory sensitivity and sensation avoiding quadrants represent over responsive patterns.

Individuals who fall in the sensory sensitivity quadrant have heightened awareness of, and are distracted by, sensory stimuli due to a low threshold, but they tend to passively cope with these sensations.

In contrast, those who are sensation avoiding not only have heightened awareness of sensory stimuli but actively attempt to avoid the ordinary sensations that they experience as noxious. One of the most important contributions of this model is that it can be used to consider what kinds of work and play or leisure environments present an optimal match for an individual's sensory modulation characteristics[17].

Sleep

Sleep quality can influence observable behaviours in children such as attention, cognitive performance, motor coordination, and certain aspects of executive functioning and children with behavioural and psychological disorders have higher rates of sleep problems .[2]

Recommended sleep amounts in children and adolescents

Age	Hours
Newborns (0-2 months)	12-18
Infants (3-11 months)	14-15
Toddlers (1-3 years)	12-14
Preschoolers (3-5 years)	11-13
School-age children (6-10 years)	10-11
Teens (10-17 years)	8.5-9

Factors affecting sleep

Sleep disorders in children with autism are common, and much can be done in primary care when parents present with their children and report sleeping problems[25].

Inadequate sleep during childhood is an invisible phenomenon that fails to receive attention from primary care providers until it interferes with the child's behavior, mood, or performance[26,27,28.] Inadequate sleep takes many forms: difficulty with sleep onset, length, or circadian rhythms with resulting daytime sleepiness experienced by otherwise healthy children; disturbed sleep associated with acute and chronic illness; and primary sleep disorders. The assumptions are made that children require regular patterns and specific hours of sleep according to developmental stage and that inadequate sleep is undesirable and potentially deleterious to health[25].

Settling and waking problems

For some children with autism, fear of the unknown may prevent them from falling asleep. However, settling problems are unlikely to be the only explanation for sleeping difficulties in children with ASD and is more likely to be one of a number of root causes. In older children, waking problems may indicate that they have not yet developed mature sleeping patterns. As babies they woke up to feed every couple of hours and this pattern has persisted. This may also be an indication that they are suffering from anxiety that is

preventing them from falling into a deep sleep, or from acute nightmares that are waking them up[25.]

Common causes of daytime sleepiness in children

- *Insufficient sleep*

• Behavioural origin — sleep-onset association disorder, limit setting problems, timing of sleep (eg, to fit with family schedules)

• Circadian rhythm sleep disorder — delayed sleep-phase syndrome, sleep entrainment difficulties (in blind children and those with developmental delay)[25]

- *Sleep fragmentation*

• Behavioural origin — sleep-onset association disorder

• Sleep-related breathing disorder — snoring, sleep apnoea

• Parasomnias — night terrors, sleep talking, sleep walking

• Medical causes — asthma, eczema, epilepsy

• Environmental causes — noise, light[25]

- *Increased need for sleep*

• Temporary hypersomnolence — medical illness, drug use (illicit and prescribed)

• Recurrent hypersomnolence — depression, Kleine–Levin syndrome (periodic hypersomnia, hyperphagia, hypersexuality, and abnormal behaviours), menstrual-associated hypersomnia

• Idiopathic hypersomnolence (no cause is identified)

• Narcolepsy (excessive daytime sleepiness, cataplexy, hypnagogic hallucinations, and sleep paralysis)[25]

Social cueing problems

Problems with 'social cueing' – learning why and in what order things should happen – are common in people with autism. This may mean that children do not make the connection between their family going to bed and their own need to sleep. Some children may also find the transition from sleeping in their parent's bedroom to sleeping in their own bedroom difficult due to anxieties associated with change.[29]

Sensory issues

There can be plenty of sensory issues associated with sleep. Sensitivity to sound, touch, and visual stimuli can be distracting and distressing and can affect the process of falling asleep. Light flooding into the room or noises caused by doors or beds may create sensory issues for children with ASD.[29]

Food and Drink

Having caffeinated drinks such as tea, coffee, or coke close to bedtime might disturb sleep. Gastrointestinal problems may also cause discomfort during sleep.[25]

Behavioral sleep problems in children

Behavioral sleep problems (behavioral insomnia) in children include bedtime refusal or resistance, delayed sleep onset, and prolonged night awakenings requiring parental intervention. All of these issues are common in the pediatric population and often adversely affect the quality of life of both children and caregivers.[25]

Behavioral insomnia of childhood

Behaviorally-based insomnia in children typically presents as bedtime resistance, prolonged sleep onset, or night wakings. These issues often coexist, and many children present with both bedtime delays and prolonged nighttime awakenings that require parental intervention. Behavioral insomnia is most common in young children aged zero to five years but may persist into middle childhood and beyond. To be considered a sleep disorder, the symptoms must occur at least three times per week, persist for at least three months, and result in significant impairment of functioning in the child, parent(s), or family[17.]

Environmental Variables

Environmental factor such as climate with hot or cold , textures of bed sheet ,noises , visual stimulus also can influences sleep disturbance.[25]

Sleep and sensory processing

Sensitivity to sensory stimuli has been suggested as a contributing factor to sleep problems[7]. Both sleep and sensory modulation have been linked to overall arousal and release of the stress hormone cortisol.[8] The higher rate of sleep difficulties seen in this population may be related to difficulties in sensory modulation. Specifically, those children with ASD who behaviourally exhibit sensory over responsiveness may be more prone to sleep difficulties

compared to children with ASD who do not have SMD or who are primarily under - responsive. In addition, sensory processing patterns involving avoiding sensations, seeking out sensation, and not registering environmental stimuli have been associated with changes in sleep quality.[10]

Sensory integration therapy (SIT):

The theory of sensory integration, together with the treatment approach derived from that theory, grew from the work of Jean Ayres (1969,1972a,1972b).Sensory integration therapy is based on assumptions drawn from neuro-maturation theory and systems theory.

Neuromaturation concepts, such as hierarchical organization of cortical and sub cortical areas, developmental sequence of learning and skill acquisition, and neural plasticity, are crucial to an understanding of the mechanisms of sensory integration. Neuroplasticity, defined as the nervous system's ability to change in response to environmental input and demands, is considered to be a key postulate on which OT/SI is based.

Ayres'[23] SI theory postulated that adequate processing and integration of sensory information is an important foundation for adaptive behaviours, where adaptive behaviours mean actions such as play and activities of daily living.

Ayres hypothesized that some deficits in sensory processing and integration will result in limitations in the production of adaptive behaviours and, as such, in participation. When people experience deficits in sensory processing and integration, they struggle with the performance of everyday occupations (Ayres, 1972; Bar-Shalita et al., 2008; Bundy & Murray, 2002; Gal et al., 2007).

Adaptive responses, defined as successful interactions with the environment in response to environmental demand, can be seen as the building blocks for successful engagement and participation in occupational roles. Thus, SI/sensory processing is of concern to occupational therapists.

Systems theory also underlies sensory integration, because the focus is on the child seeking sensory input and using adaptive behavior as an organizer of the input. Based on these assumptions, the SIT approach seeks to provide the child with enhanced opportunities for controlled sensory input, with a particular emphasis on vestibular, proprioceptive, and tactile input, in the context of meaningful activity.

Occupational therapy and sensory integration is based on the belief that engagement in individually tailored activities, rich in the needed sensory stimuli, will improve the ability of the brain and nervous system to process sensory information, enhance the organization and integration of sensation, and, as a result, have a positive impact on the child's ability to participate in daily life activities (Ayres, 1972, 1979).

Through sensory integration therapy the therapist aims to facilitate an adaptive response, which requires the child to integrate the sensory information. Such facilitation is hypothesized to improve the process of SI which focuses on both developmental and reactive neuroplasticity. Developmental neuroplasticity refers to those changes that take place in the course of typical development and reactive neuroplasticity addresses changes that take place in response to biologically significant stimulus.

Recent literature has integrated occupation-based perspectives and emerging theories of motor development in the re conceptualization of sensory integration, but the methods used in SIT remains essentially unchanged.

LITERATURE REVIEW

REVIEW OF LITERATURE

Sleep Disturbance and SPD

- Stacey Reynolds, Shelly J. Lane, Leroy Thacker **Sensory Processing, Physiological Stress, and Sleep Behaviours in Children With and Without Autism Spectrum Disorders (2011)** American Occupational Therapy Foundation .The purpose of this study was to examine the relationship **between physiologic responses to sensation and sleep in children with and without ASD.** Fifty-five children participated in the study (ASD, n = 27; typical, n = 28). All children participated in a sensory challenge laboratory protocol. Electro dermal reactivity and salivary cortisol were used as physiological indicators of sensory responsivity. Behavioural data were collected using the **Sensory Profile and the Child Behaviour Checklist**. Results confirmed that children **with ASD have a higher prevalence of atypical sensory behaviours and sleep disturbances than typical children**. Atypical sensory behaviours such as child waking often during the night or waking too early in the morning, restlessness during sleep, and difficulty falling asleep, significant affective problems and greater difficulty with reciprocal social interaction are important to consider in relation to sleep deficits in children.

- James Williamson, Vasak, M.Zwicker, J. G. and Garden, J.**Sensory Processing and Sleep in Typically Developing Infants and Toddlers** AJOT 2015. The study aims to find out the relationship between sensory processing pattern and sleep behaviour in typically developing infants and toddlers. A retrospective review of 177 infants and toddlers from a community occupational therapy sleep clinic. **Sensory Profile and Brief Infant Sleep Questionnaire** were completed by parents. They found half of participants (55%) demonstrated a pattern of increased **sensory processing in one or more quadrants**, with sensitivity being most common (36%). And also small but significant correlations between increased **seeking and shorter daytime sleep duration and between increased sensitivity and longer time to settle to sleep** .**This Results support the role of occupational therapy in addressing sleep difficulties in children.**

- Koenig, K. P., &Rudney, S. G. ***Performance challenges for children and adolescents with difficulty processing and integrating sensory information: A***

systematic reviewAJOT(2010).The study proves that **children who had tactile sensitivity had significantly higher disturbances in sleep behavior, and differences in tactile sensitivity accounted for 25% of the variance in sleep behaviors**.The review focused on functional performance difficulties that these children may exhibit in areas of occupation including play and leisure, social participation, activities of daily living, instrumental activities of daily living, **rest and sleep**, education, and work. The results suggest that **children and adolescents with difficulty processing and integrating sensory information do exhibit functional performance difficulties in key areas of occupation.**

- Tamar Shochat & Batya Engel-Yeger***Sensory Hypersensitivity as a Contributing Factor in the Relation Between Sleep and Behavioral Disorders in Normal Schoolchildren (2008).*** Journal of Autism and Developmental Disorders.The aim of the study was to **explore the contribution of sensory hypersensitivity and its relation between sleep and behavioural disorder**. Parents of 56 schoolchildren completed questionnaires **reporting sleep habits, behavior, and sensory processing. S**ignificant relationships between sensory processing, sleep, and behavior in a sample (n = 51) of typically developing schoolchildren. Significant correlations were found between global scores of all 3 constructs; however, the relationship between sleep and behaviour decreased when controlling for sensory processing. **Among different sensory modalities, tactile sensitivity was a significant predictor for sleep, accounting for 25% of the variance** and sensation seeking and tactile sensitivity were significant predictors for behaviour, accounting for 42% of the variance. **The results of this study suggest that sensory profiles of children with sleep or behavioural disorders should be routinely assessed in clinical practice.**

Behavioural treatment for sleep disturbance

- Jodi A. Mindell, Brett Kuhn, **Behavioural Treatment of Bedtime Problems and Night Wakings in Infants and Young Children .** An American Academy of Sleep Medicine Review(2006). This paper reviews the evidence behavioural intervention to reduce night waking and bedtime problems. It is based on a review of 52 treatment studies by a task force appointed by the American Academy of Sleep Medicine to develop practice parameters on behavioural treatments for the clinical

management of bedtime problems and night waking in young children. **The findings indicate that behavioural therapies produce reliable and durable changes.** Across all studies, 94% report that behavioural interventions were effigy carious, with over 80% of children treated demonstrating clinically signify -cant improvement that was maintained for 3 to 6 months.

- Jennifer L. Vriend,1 BSC, Penny1Department of Psychology, Dalhousie University, and 2Psychology, IWK Health Centre. **Behavioral Interventions for Sleep Problems in Children With Autism Spectrum Disorders:** Current Findings and Future Directions(2011).A systematic review evaluating all published studies examining the effectiveness of behavioral treatment of sleep problems in children with ASD is presented. Results Based on the Chambless criteria for treatment efficacy, **both standard extinction and scheduled awakenings met criteria for possibly efficacious interventions for sleep problems in children with ASD.** Some positive outcomes have been reported, but there has not been enough research examining graduated extinction, faded bedtime, stimulus fading and chronotherapy to make any firm conclusions regarding treatment efficacy for children with ASD.

- **Beth A. Malow, MD, MS**1, **Karen W. Parent-Based Sleep Education for Children with Autism Spectrum Disorders,**NIHPublicAccess(2014 January).This study provided to determine whether an **individual or group format was more effective in improving sleep and aspects of daytime behavior and family functioning.** Eighty children, ages 2-10 years, with ASD and sleep onset delay completed the study**. Actigraphy and parent questionnaires** were collected at baseline and one month after treatment. Mode of education did not affect outcomes. **Sleep latency, insomnia subscales on the Children's Sleep Habits Questionnaire,** and other outcomes related to child and family functioning improved with treatment. Parent-based sleep education, delivered in relatively few sessions, was associated with **improved sleep onset delay in children with ASD.** Group vs. individualized education did not affect outcome.

Sleep pattern in atypical children

- LuciWiggs, Gregory Stores, University of Oxford Department of Psychiatry, Oxford, UK. **Sleep patterns and sleep disorders in children with autistic spectrum disorders: insights using parent report and actigraphy,***Developmental Medicine & Child Neurology* 2004. The present study sought to describe the sleep disorders in children with ASD and to document any sleep disorders underlying reports of sleeplessness. Sixty-nine children aged 5 to 16 years (mean 9 years 4 months, SD 2 years 7 months; 14 females) with an ASD were assessed by detailed **sleep histories taken from parents, the Simonds and Parraga Sleep Questionnaire, a 2-week sleep diary, and actigraphs worn by the child for five nights. Parent-reported sleeplessness featured prominently (64%).**sleep disorder underlying the sleeplessness were most commonly behaviour, although sleep wake cycle disorders and anxiety – related problems were also seen. Identifying sleep disorder, rather than problems, has important practical consequences**.** Because the choice of the treatment needs to be based on the individual sleep disorder, not simply the presenting symptoms.

- Kumar narasingharao , Balarampradhan , Janardhananavaneethan **Sleep Disorder Gastrointestinal Problems and Behaviour Problems Seen in Autism Spectrum Disorder Children and Yoga as Therapy:** A Descriptive Review Journal of Clinical and Diagnostic Research. Nov (2016).This research have shown that apart from behaviour problems, the ASD children also suffer from **physiological conditions such as disturbed sleep** and gastrointestinal problems that could be the contributing factors to their daytime behaviour problems. Lots of parents have expressed that, **lack of sleep among the children have resulted in high levels of stress among the family members** particularly among the immediate caretakers which are in most cases the mother of the child. Early behaviour intervention is a norm for ASD children which mainly affect the psychological level. Through this paper, an effort has been made to study the contributions made by **yoga in order to mitigate such problems. Yoga is a non-invasive and alternative therapy that brings change in both physiological and psychological level of an individual.** Parental based yoga intervention can be more effective for both children and parents and subsequently to the entire family.

- Penny Corkum, Rosemary Tannock, **Actigraphy and Parental Ratings of Sleep in Children with Attention-Deficit/Hyperactivity Disorder (ADHD) January 2001** To assess various sleep parameters in latency-aged children with ADHD and their normally developing peers through the use of multiple sleep measures. Six sleep parameters were evaluated for two groups of children, ADHD and normal comparison. Each group consisted of 25 children (20males, 5 females) who ranged in age from 7 to 11 years. All children underwent rigorous diagnostic procedures and the ADHD subjects were selected only if they displayed pervasiveness in their symptomatology and were medication naive. Parents completed a retrospective questionnaire which evaluated sleep problems over the past six months. Based on the findings from the questionnaire, parents of children with **ADHD reported significantly more sleep problems than parents of normally developing children.**

- **Vijayasree. Bandikolla, A review of autism spectrum disorders and complications** *International Journal of Information Research and Review January, 2016* . The present study review indicates about Autism, Autism Disorders and symptoms, behavior problems, Diagnosis, General considerations and **sleep Disturbances**. Sleep problems are common in children and adolescents with ASDs at all levels of cognitive functioning. Sleep problems correlate with family distress and may have significant effects on daytime functioning and quality of life of children with ASDs. **Occupational therapy promotes progress by addressing comorbid difficulties of sensory deficits and** motor coordination (Myers *et al*., 2007).

- Judith Owens , Reut Gruber **,** Thomas **Brown Future Research Directions in Sleep and ADHD: Report of a Consensus Working Group Journal of Attention Disorders** 2012 .This study To explore relationships between basic and translational science research regarding **sleep and ADHD in children**. A multidisciplinary group of experts in pediatric sleep medicine and ADHD convened in November 2010 to summarize the current literature, delineate knowledge gaps, and formulate recommendations regarding future research directions and priorities. **Six major research areas of interest were identified:** (a) brain centers **regulating sleep, arousal**, and attention; (b) neurotransmitter systems involved in both **sleep and attention regulation;** (c) alterations of neural systems regulating sleep in ADHD;

(d) phenotypic similarities between behavioral, mood, and **cognitive manifestations of insufficient/disrupted sleep and ADHD;** (e) hypoarousal and sleepiness in ADHD; and (f) **external sleep–wake signals that affect sleep regulation in ADHD.** This study concluded with An enhanced understanding of the **complex mechanisms regulating sleep promotion,** wakefulness, and attention may contribute to new insights regarding **the core impairments in ADHD and lead to the development of new therapies.**

CONCEPTUAL FRAMEWORK

CONCEPTUAL FRAMEWORK

Sleep quality can influence observable behaviours in children such as attention, cognitive performance, motor coordination, and executive functioning and children with behavioural and psychological disorders have higher rates of sleep problems [2,]**Sleep impacts every aspect of child development, including learning, processing and remembering information**. Findings demonstrate that different ways of attending to sensory experiences, particularly increased sensitivity, are correlated with reductions in sleep quality.

Although issues with sleep have been identified in children with sensory processing difficulties[16], the association of sensory processing patterns with sleep in infants and toddlers aged 0–36 mo is largely unknown. Therefore this study focuses on the impact of sensory integration on sleep disturbance among children with sensory processing disorder.

A study done by **Ricardo A .Velluti (1997)** focuses on the **interactions between sleep and sensory physiology.** The findings of the study suggest that any sensory stimulation, if strong enough, will always awaken the sleeping subject regardless of the sleep stage. Normal sleep depends in many ways on sensory input and that the sleep and waking control networks are modulated by several inputs, and therefore a proportion of passive effects must be associated with active sleep mechanisms for entering and maintaining normal sleep**. All sensory systems (somato-sensory system, olfactory system, vestibular system, vision and auditory system) demonstrated influence on sleep and, at the same time, the sensory systems undergo changes that depend on the sleeping or awake state of the brain.**

Also, every sensory system shows an efferent pathway, i.e. centrifugal fibers that reach all nuclei of the afferent pathway as well as the receptors themselves. Thus, sensory information entering through the receptors may alter sleep and waking physiology and, conversely, the sleeping brain imposes rules on incoming information.

It is suggested that the **neural networks responsible for sleep and waking control are actively modulated by sensory inputs in order to enter and maintain normal sleep and wakefulness.** Furthermore**, both sensory stimulation and deprivation may induce changes in sleep/ waking neural networks**. This leads to the conclusion that the central

nervous system and sensory input have reciprocal interactions, on which normal sleep/waking cycling and behaviour depends.

Occupational therapists frequently use sensory integration treatment to address functional deficits in children with ASD[10]. Miller et al. (2007) documented improvement in children with SMD following sensory integration treatment.

Meryl Marger [6] developed a study to study the effectiveness of intervention on individuals with sleep disturbance. She suggested that cognitive or behavioural therapy interventions, or sensory integration strategies are used to address sleep disturbances.Therefore it is assumed that sensory integration therapy can have an effect on reducing sleep disturbance among children with SPD children.

Autonomic nervous system implicated in SPD

Researchers have demonstrated that individuals with SPD have abnormal sympathetic and parasympathetic reactions in response to sensory stimuli. Pollack has reported that Schaaf, Miller, Seawell, and O'Keefe's (2003) study examines parasympathetic disturbance in relation to SMD. Measures were taken during the Sensory Challenge Protocol, which is a test that measures responses to repeated sensory stimulation in 5 areas with 10 continuous trials. Areas include olfactory, auditory, visual, tactile, and vestibular. The participants with disturbances in sensory modulation had statistically significant lower cardiac vagal tone, which serves as evidence of less effective parasympathetic functioning

Sensory integration frames of reference

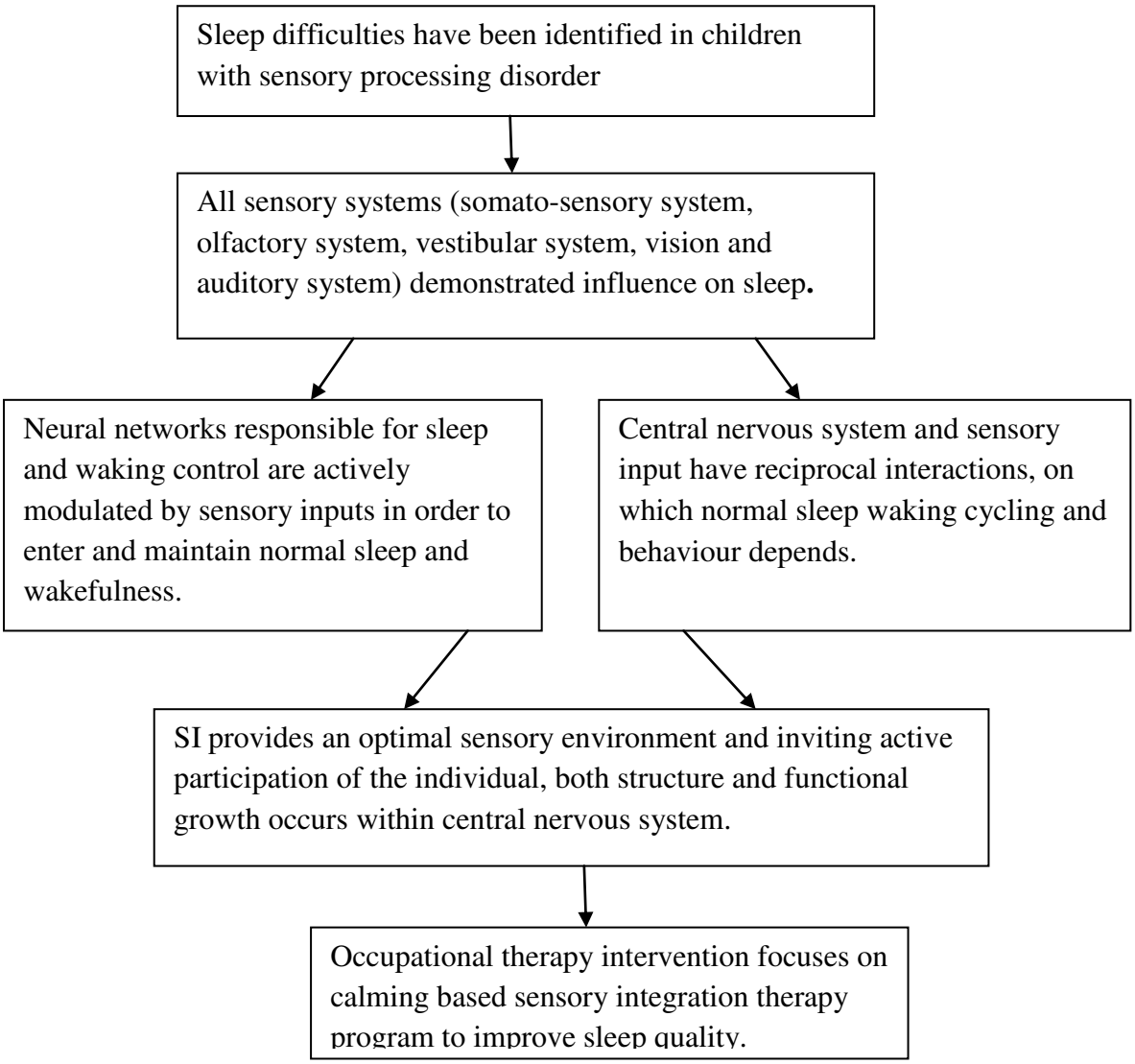
The theoretical base of sensory integration frames of reference is unique in that it deals specifically with the contributions of the subcortical areas of the brain to human behavior. The five systems auditory, visual ,vestibular, proprioceptive and tactile provide the basis for the development of functional support capabilities that lead to the end product abilities. To produce the desired adaptive response in end product ability, the person must have sensory system modulation within normal levels and reasonable functional support capabilities. Optimal functioning means all systems and capabilities work integratively.

Sensory integration theory proposes that by providing an optimal sensory environment and inviting active participation of the individual, both structure and functional growth occurs

within central nervous system. Vestibular, tactile, and proprioceptive systems are primitive and primary; they dominate the child's interactions with the world early in life. These 3 systems are highlighted to be the precursors to development of auditory and visual system.

Occupational therapy intervention:

This understanding enables occupational therapy intervention to focus on calming based sensory integration therapy program to improve sleep quality.



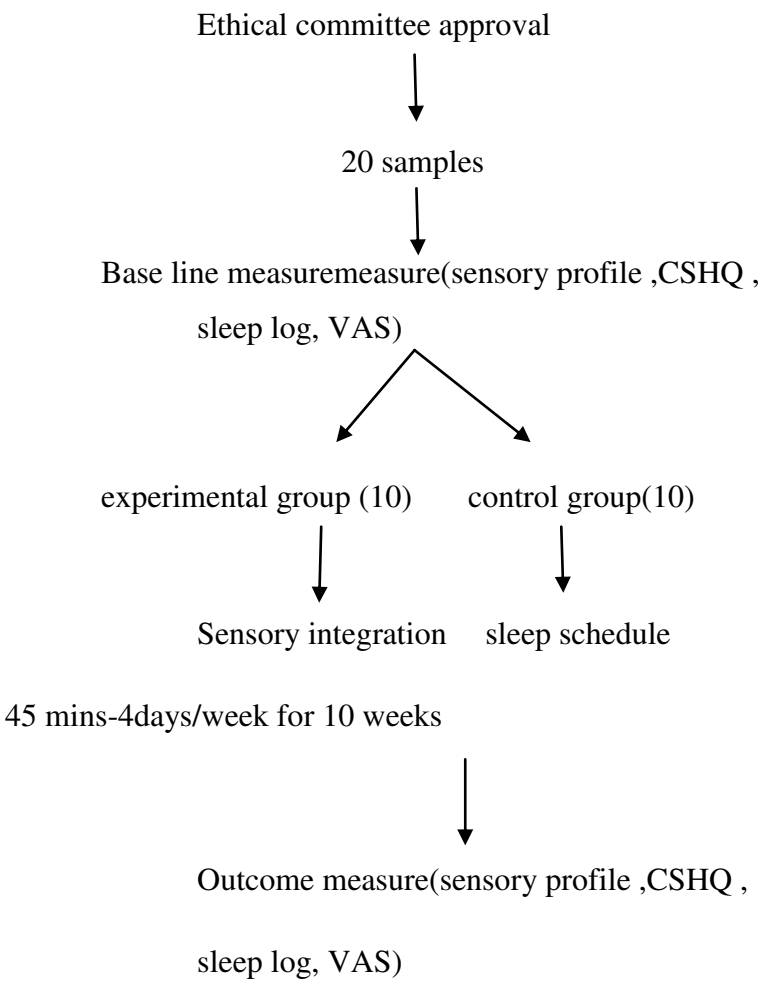
METHODOLOGY

METHODOLOGY

Research design: 2 group Quasi experimental pre-post test design.

Experimental group underwent sensory integration and control group underwent sleep schedule

Schematic Representation of the Research Design



Setting of the study:

The study was conducted in and around the Coimbatore and also outside the Coimbatore. This includes,

- Department of occupational therapy ,Kovai Medical Centre and Coimbatore.
- Shriano Therapy Centre, Gandhipuram, Coimbatore.
- Sri Prasanthi Academy,Saravanampatty, Coimbatore.

Sampling:

Convenience sampling method was used to select the sample based on criteria.

Sample population:

Children with SPD having sleep problems are included for the study purpose.

Sample size:

The study includes 20samples

- Experimental group:10
- Control group:10

Selection criteria

Inclusion criteria

- Children with conditions like ASD, ADHD, LD, fragile X ,Aspergers syndrome etc. with Sensory Processing Disorder(SPD).
- Children between 3-10 years of age
- Both boys and girls

Exclusion criteria

- Children who have any type of physical dysfunction including CP, muscular dystrophy , congenital amputation , spinal muscular dystrophy etc..
- Children with severe visual and hearing impairments.
- Serious confounding life events such as the death of a parent, abuse or neglect, or residence in a foster home.

- Children who are taking medication, such as Melatonin, for sleep disorders or any other medication with side effects of causing sleep .

Variables

- Independent variables – sensory integration therapy
- Dependent variables – sleep quality may
- Extraneous variables – children's availability for treatment sessions.

Tools, Equipments and Outcome Measures

1.Sensory profile

- The Sensory Profile is a 125-question caregiver-completed profile that reports the frequency of the person's response to various sensory experiences (Dunn, 1999).
- Caregivers are asked to check the box that best describes the frequency with which the subject engages in the listed behaviors.
- Choices are: never (five points); seldom (four points); occasionally (three points); frequently (two points); and always (one point).
- On the Sensory Profile, lower scores indicate greater SPD symptoms.
- The Sensory Profile includes high and low threshold items. High threshold items measure an individual's lack of response or need for more intense stimuli. Low threshold items measure a person's notice of or annoyance with sensory stimuli.
- Psychometric property: The Cronbach's Alpha for the internal consistency for the various sections ranged from.47 to .91 (Dunn, 1999). Construct validity was rated as high when compared to the functional tasks measured by the School Function Assessment (Coster, Deeney,Haltiwanger, & Haley, 1998). Internal validity correlations ranged from .25 to .76, suggesting that the sections of the Sensory Profile use relatively unique constructs and support the factor structure.

2. The Children's Sleep Habits Questionnaire (CSHQ)

It waSDeveloped by Judith Owen (2000). The CSHQ is a retrospective, 33-item parent questionnaire that has been used in a number of studies to examine sleep behaviour in young children.

- Eight subscales reflecting the following sleep domains: 1) Bedtime Resistance, 2) Sleep Onset Delay, 3) Sleep Duration, 4) Sleep Anxiety, 5) Night Wakings, 6) Parasomnias, 7) Sleep- Disordered Breathing, 8) Daytime Sleepiness.

- Parents are asked to recall sleep behaviors occurring over a "typical" recent week. Items are rated on a three-point scale: "usually" if the sleep behavior occurred five to seven times/week; "sometimes" for two to four times/week; and "rarely" for zero to one time/week.

- The total and subscale scores listed in the SLEEP paper are based on the 1-3 scoring system described above, except that sleepiness items 32 and 33 were scored as: default (not checked) = 0, "very sleepy"= 1 and "falls asleep"= 2. suggested a cut-off score of *greater than* 41 has indicative of more disturbed sleep. High scores indicate higher sleep disturbance.

- Internal ConsistencyThe internal consistency of the entire CSHQ was 0.68 for the community sample and 0.78 for the clinical sample.

3. Sleep log

- Sleep diary or sleep log is a record of an individual's sleeping and waking times with related information usually over a period of several weeks, which is recorded by parents.

- It is represented in a clock diagram which resembles a pie chart, indicated hourly, in which the parents mark the hours of child's sleep. It can help make the parents and therapists more aware of the parameters affecting the child's sleep.

4.Visual Analogue Scale (VAS)

- Visual Analog Scale is usually used for pain assessment. Could also been used for measuring children sleep quality and for measuring parents' satisfaction.

- Parents were asked to place a mark through a horizontal line (100 mm single item visual analogue scale) to indicate how much satisfied they were at present with the sleep behavior of their child. Line anchors were “Not satisfied at all” (marked as 0%) and “Fully satisfied” (100%). This 100mm line was divided into 10 equal parts by placing vertical lines each of which is further assigned a value of 10-90% from left to right.

Procedure

- Ethical clearance from the head of the institution to conduct study.
- The purpose of the study was explained and informed, also a written consent obtained from the parents prior to the study.
- Using convenient sampling,20children were selected they were divided into 2 groups randomly: experimental and control,10 in each
- Baseline measures were collected using sensory profile, CSHQ, visual analogue scale sleep log. The modified baseline schedule marked by the parents for 1 week was collected prior to the intervention.
- Both experimental group and control group were undergoing regular occupational therapy session and sleep schedule for children.

For Experimental Group,

1. SI treatment was based on the particular sensory processing disorders faced by each child according to sensory profile and the goal was to integrate those disorders which affect sleep. The therapy room was equipped with mats, swings, small trampoline, therapeutic balls and a variety of toys that offer sensory stimulus (weight, vibration, etc.).

2. After completion of the therapy session the caregiver was briefed about the session.

3. Parents were given a list of activities which is **calming based on sensory activities** to be done at home for children before going to bed.

Examples:

Tactile defensiveness

- Bath in warm water.
- Applying lotion over the extremities.
- Squeezing games.
- Use firm pressure on arms and legs.

Proprioceptive seeking

- Neutral warmth with pressure
- Sequencing pressure over the extremities

Vestibular sensory issues

- Slow swinging
- Slow rock in rocking chair

Auditory sensory issues

- Calming music in a quiet room
- Instrumental lullaby

Visual sensory issues

- Dark or dim lights

Intervention was continued for 10 weeks, 4 days in a week for 45minutes by the researcher.

For the control group,

Sleep schedule

- Keeping a regular sleep schedule As much as possible (given the changes that go along with daily life), child should have a bedtime and wake time that is the same 7 days per week.

- If child takes more than an hour to fall asleep, change the bedtime by 30 minutes to 1 hour to try to help with sleep. Try to keep their schedule no more than one hour later for bedtime and one hour later for waking on days.
- Even if the child goes to sleep late at times, keep the same wake time and not more than one hour later than the normal wake time.
- If the child is younger and has a daytime nap, keep the nap times on a regular schedule. When possible, the nap should be in the child's bedroom. Wake the child by 4 pm from afternoon naps or it will be hard for him to fall asleep at bedtime.
- Child should eat breakfast each morning at around the same time, both on weekdays and weekend days. At the end of the day, child should not be given heavy meals or large snacks late at night.
- Making the environment comfortable for the child such dim lights, adequate air circulation and avoiding excessive noise.
- However, a light dinner with carbohydrates (for example idly, dhosa) may help the child fall asleep more easily.
- To avoid gadgets like cell phone, tab, watching TV, video games, laptop, watching cartoon shows, highly explorative toys.
- Avoid heavy meals, sugarated snacks, and crunchy items.
- Avoid drinks such as coffee, tea, aerated drinks.
- Avoid excessive sensory stimulatory activities such as fast swinging, jumping.

DATA ANALYSIS AND RESULTS

DATA ANALYSIS AND RESULTS

To reach the aim of finding association between sleep disturbance and sensory processing disorder, the study was conducted with the objective to evaluate the effectiveness of sensory integration therapy on sleep disturbance among children with SPD.

The scores of the experimental and the control group were subjected to statistical analysis by using IBM SPSS version 20. The descriptive analyses were performed to characterize the groups and inferential analyses to compare the performance of the groups (Mann Whitney U, Wilcoxon) were used.

Descriptive statistics was used to find out the mean SD
Wilcoxon signed rank test was used for the within group comparison.
[Table no : 2.1,3.2,4.2,5.3,5.4,6.2,6.4,7.3]
Mann-whitney U test was used for the comparison between groups.
[table no:2.2,3.1,4.1,5.1,5.2,6.1,6.3,7.1,7.2]

Table 1.1: Demographic Details of the Participants in the study (Gender)

gender	**group**	**n**	**%**
boys	exp	8	80%
	cont	8	80%
girls	exp	2	20%
	cont	2	20%

Table 1.2 Demographic Details of the Participants in the study (Age)

Groups	mean	SD	min	max
exp	3.95	0.55	3.10	5.00
cont	3.99	0.73	3.00	6.60

Table 1.1 &1. 2 as shown in the study consisted of 20 children with SPD among who 16 boys and 4 girls , the children age ranged from 3-10 years with a mean age of 3.95 SD 0.55 and mean age of 3.94 SD 5.60 in experimental and control group respectively .

Table 2.1comparison of Pre & Post Test Scores Of Children Sleep Habit Questionnaire For Experimental And Control Group

Group	Test	Mean	SD	Z scores	sig
Exp	Pre	56.10	3.34	-2.810	**.005**
	Post	37.90	1.72		
Con	Pre	56.70	51.00	-.841	.400
	Post	55.70	50.00		

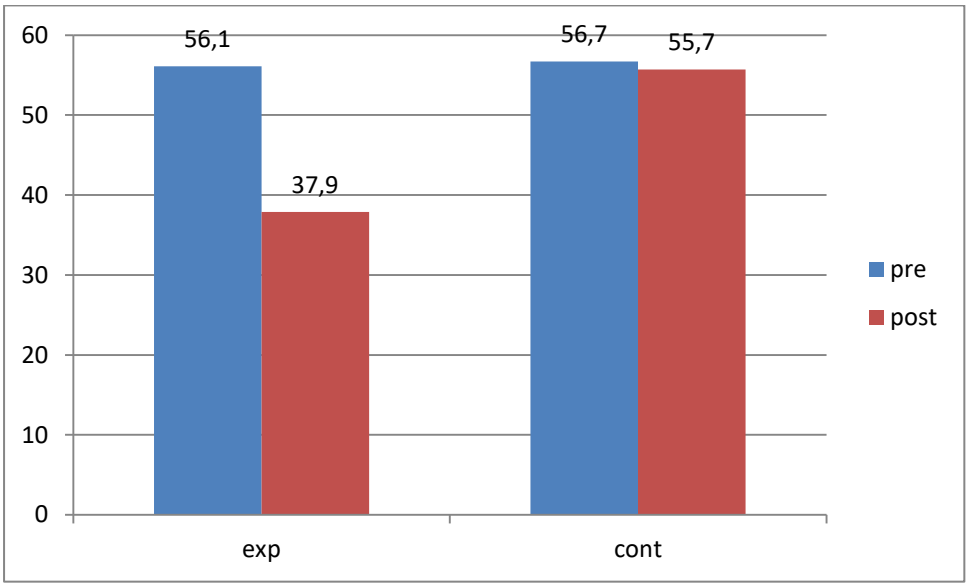
Shows that mean & SD and the result shows that there is significant difference in the pre & post test scores of experimental groups, but not in the control group .

Table 2.2comparison between control and experimental group scores[Pre test and Post Test on children sleep habit questionnaire]

Test	Group	Mean Rank	Sum of rank	U score	Sig(2tailed)
Pre	experimental	11.25	112.50	42.500	.568
	Control	9.75	97.50		
Post	experimental	5.50	55.00	.000	**.000**
	Control	15.50	155.00		

Mann whitney U test reveal that there is no significant different in pre test scores indicating homogeneity of the group prior to intervention and shows there is significance difference in the post test of sleep disturbance.

Graph 2 **Comparison between pre & post test scores on children sleep habit questionnaire for experimental and control goup.**



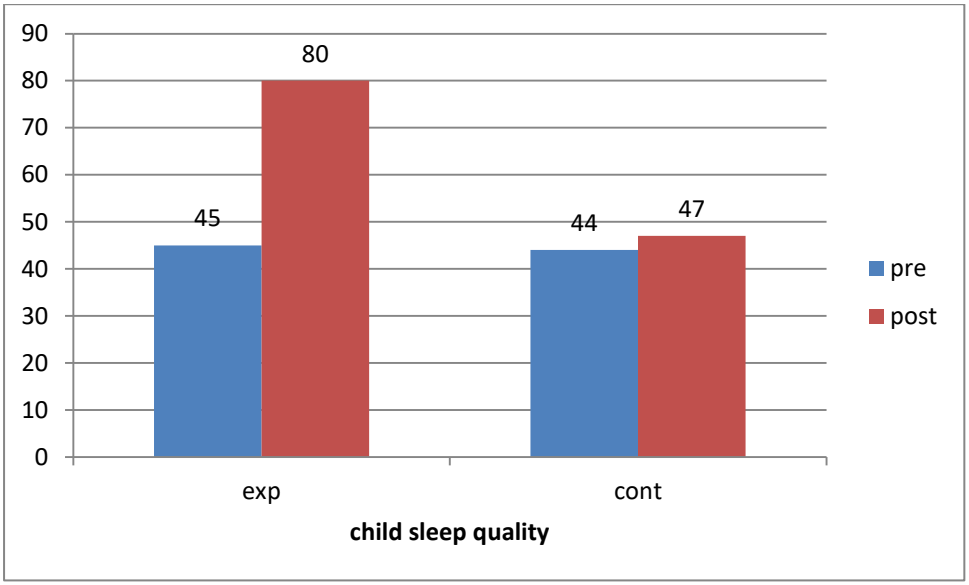
The graph shows the reduction in sleep disturbance on experimental group groups not in control group.

Table 3.1 comparison of pre & post test of visual analogue –child sleep quality for experimental and control group.

Group	**Test**	**Mean**	**SD**	**Z scores**	**sig**
Exp	Pre	45.00	5.27	-2.844	**.004**
	Post	80.00	6.66		
Con	Pre	44.00	5.16	-1.732	.083
	Post	47.00	4.83		

Shows the mean & SD of VAS: children sleep quality The results shows that there is significant differences in the experimental group in the measures of VAS: children sleep quality p is 0.04(<0.05) ,but not in the control group.

Graph 3: Comparison between pre and post test VAS- child sleep quality for experimental & control group.



The graph shows the improvement in sleep quality of both groups .It is evident that the experimental group have shown higher improvement than control group.

Table 3.2 Comparison between control and experimental group Scores Pre test and Post Test on child sleep quality -VAS

Test	Group	Mean Rank	Sum of rank	U score	Sig(2tailed)
Pre	experimental	11.00	110.00	45.00	.661
	Control	10.00	100.00		
Post	experimental	15.50	155.00	45.00	**.000**
	Control	5.50	55.00		

Shows that there is no significant differences in the pre-test of the child sleep quality P is 0.66(>0.05) .This indicates that there is homogeneity of the group and thus post test score can be compared. There is significant differences in the post test P is 0.00(<0.05) indicating that the experimental group has improved in sleep quality.

Table 4.1comparison of pre& post test scores of parents satisfaction –VAS

Group	Test	Mean	SD	Z scores	sig
Exp	Pre	52.00	6.32	-2.877	**.004**
	Post	84.00	6.99		
Con	Pre	46.00	5.16	-1.342	.180
	Post	49.00	3.16		

The above tables Shows the statistics of VAS: parent's satisfaction and the results shows that there is significant differences in the experimental group -parent's satisfaction p is 0.004<0.05). And there is no significant difference in the control group.

Graph 4: comparison between control and experimental group scores [of pre& post test scores of parents satisfaction –VAS]

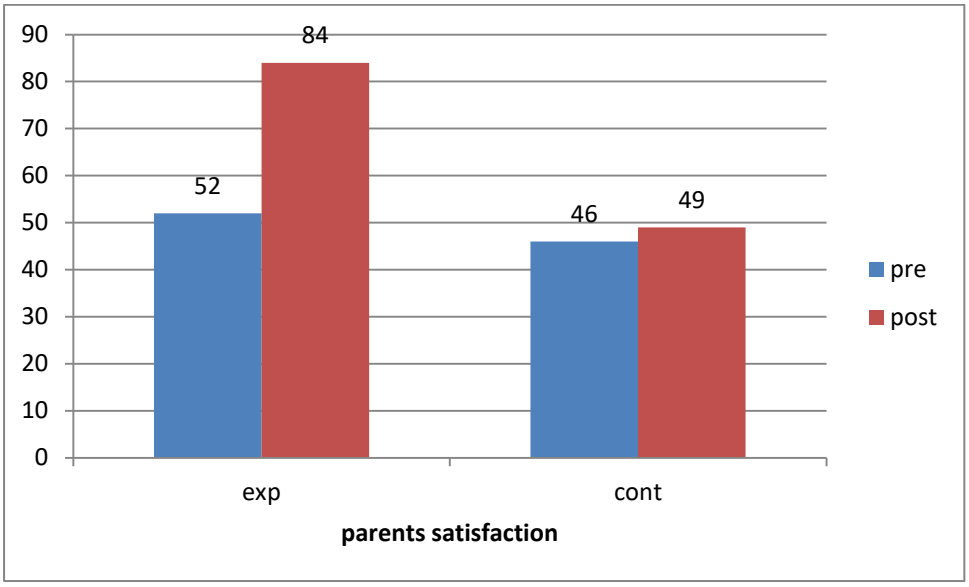


Table 4.2 comparison between experimental and control group scores [pre test & post test Scores of VAS- parents satisfaction]

Test	Group	Mean Rank	Sum of rank	U score	Sig(2tailed)
Pre	experimental	12.90	129.00	26.000	**.038**
	Control	8.10	81.00		
Post	experimental	15.50	155.00	.000	**.000**
	Control	5.50	55.00		

The above tables Shows that there is significant differences in both pre-test and post test of the parents satisfaction p is 0.38(<0.05) respectively. There is significant differences in the post test of satisfaction; P is 0.00(<0.05).

Table5.1a comparison of pre & post of section component on experimental group

Section	pre		post		Z score	sig
	mean	SD	mean	SD	-2.803	**.005**
Auditory processing	23.30	10.72	35.00	4.34		
Visual processing	27.90	9.538	37.00	4.71	-2.807	**.005**
Vestibular processing	28.90	15.30	49.40	3.56	-2.805	**.005**
Touch processing	58.70	25.34	81.80	6.98	-2.805	**.005**
Multisensory processing	24.00	8.459	31.20	5.84	-2.812	**.005**
Oral sensory sensitivity	40.50	11.20	54.50	5.12	-2.803	**.005**
Sensory processing related to tone /endurance	25.90	13.64	42.50	2.12	-2.803	**.005**

Table 5.1b

Section	pre		post		Z score	sig
Modulation related to body position and movement	mean	SD	mean	SD	-2.547	**.011**
	30.10	14.57	46.50	2.12		
Modulation of movement affecting activity level	23.20	7.671	26.80	3.08	-1.605	.108
Modulation of sensory input affecting emotional responses	12.30	6.037	18.30	1.56	-2.398	**.016**
Modulation of visual input affecting emotional responses and activity level	11.90	3.414	18.00	1.41	-2.809	**.005**
Emotional /social responses	52.10	27.35	69.90	4.81	-2.809	**.005**
Behavioural outcomes of sensory processing	17.00	7.241	26.50	2.95	-2.807	**.005**
Items indicating thresholds	9.000	3.565	13.90	1.37	-2.820	**.005**

Table 5.1a&b Show the statistics of sensory profile of section component of experimental group and The result shows that there is significant differences in the experimental group for Auditory Processing ,Visual Processing,Vestibular processing, Touch Processing, Multisensory Processing, Oral Sensory Processing, Sensory Processing Related to tone/endurance ,Modulation Related to Body Position and movement, Modulation of Sensory Input Affecting Emotional Responses, Modulation of Visual Input ,Affecting Emotional Responses and Activity Level.

Table 5.2 comparison of pre and post test scores section component on control group

Section	pre		post		Z score	sig
	mean	SD	mean	SD		
Auditory processing	27.80	8.80	27.20	8.41	-3.687	.713
Visual processing	37.80	5.50	38.10	4.70	-1.000	.317
Vestibular processing	38.00	14.42	38.00	14.4	.000	1.000
Touch processing	64.10	23.84	63.80	23.5	-1.000	.317
Multisensory processing	20.60	9.77	23.00	9.76	-1.342	.180
Oral sensory sensitivity	44.90	12.05	41.50	16.18	-1.342	.180
Sensory processing related to tone /endurance	37.90	9.94	35.80	12.1	-1.000	.317

Table 5.2b

Section	pre		post		Z score	sig
Modulation related to body position and movement	mean	SD	mean	SD	-1.000	.317
	44.80	3.42	44.50	3.02		
Modulation of movement affecting activity level	24.90	4.01	25.00	4.13	-1.000	.317
Modulation of sensory input affecting emotional responses	17.80	2.48	17.80	2.48	.000	1.00
Modulation of visual input affecting emotional responses and activity level	16.30	3.59	16.30	3.59	.000	1.00
Emotional /social responses	67.90	10.41	67.90	10.4	.000	1.00
Behavioural outcomes of sensory processing	22.60	5.75	22.60	5.75	.000	1.00
Items indicating thresholds	11.30	3.335	11.3o	3.33	.000	1.00

Shows the statistics of sensory profile of section component of control group and there is no significant differences in this group

Table 5.3a comparison between Pre Test Scores of Experimental and Control Group in SP

Section	Group	Mean rank	Sum of rank	U score	Sig(2tailed)
Auditory processing	Exp	9.15	91.50	36.50	.306
	Con	11.85	118.50		
Visual processing	Exp	7.15	71.50	16.50	**.011**
	Con	13.85	138.50		
Vestibular processing	Exp	9.20	92.00	37.00	.324
	Con	11.80	118.00		
Touch processing	Exp	9.90	92.00	44.00	.650
	Con	11.10	111.00		
Multisensory processing	Exp	11.35	113.50	41.50	.515
	Con	9.65	96.50		
Oral sensory sensitivity	Exp	9.10	91.00	36.00	.289
	Con	11.90	119.00		
Sensory processing related to tone /endurance	Exp	7.55	75.50	20.50	**.024**
	Con	13.45	134.50		

Table 5.3b

Modulation related to body position and movement	Exp	7.55	75.50	20.50	**.024**
	Con	13.45	134.50		
Modulation of movement affecting activity level	Exp	9.60	96.00	41.00	.4893
	Con	11.40	114.0		
Modulation of sensory input affecting emotional responses	Exp	7.35	73.50	18.50	**.016**
	Con	13.65	136.50		
Modulation of visual input affecting emotional responses and activity level	Exp	6.95	69.50	14.50	**.007**
	Con	14.05	140.50		
Emotional /social responses	Exp	8.95	89.50	34.50	.240
	Con	12.05	120.50		
Behavioral outcomes of sensory processing	Exp	8.15	81.50	26.50	.075
	Con	12.85	128.50		
Items indicating thresholds	Exp	7.95	79.50	24.50	.**051**
	Con	13.05	130.50		

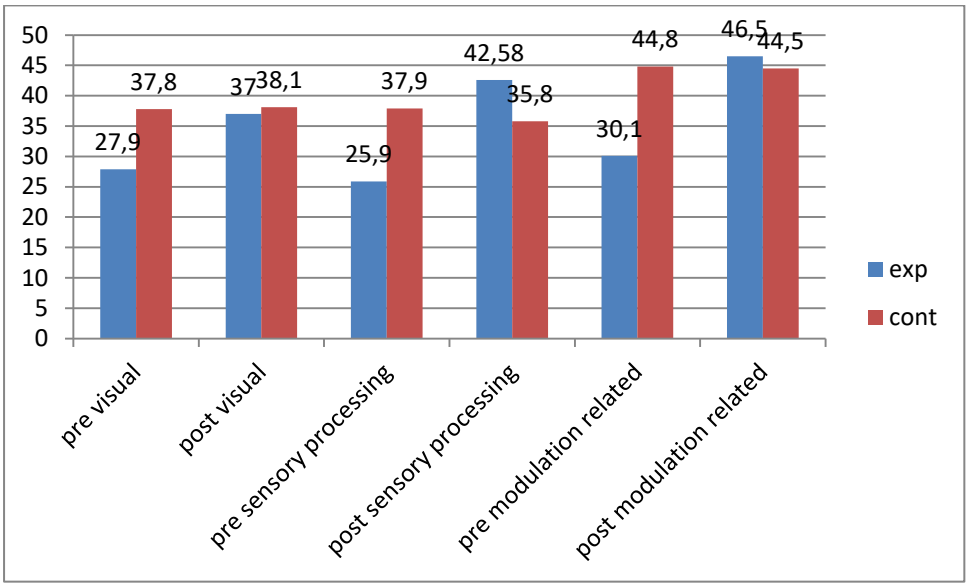
Table 5.3a&b The results shows that there is significant differences in pre test scores of the component of section in sensory profile ,visual processing is (p is 0.01<0.05), Sensory processing related to tone /endurance and Modulation related to body position and movement (p is 0.024 <0.05),Modulation of sensory input affecting emotional responses(p is 0.016 <0.05),Modulation of visual input affecting emotional responses and activity level (p is 0.007 <0.05),Items indicating thresholds (p is 0.051<0.05). Indicating these sections cannot be compared in post test. Other sensory section can be compared at post test level.

Table 5.4 Post Test Scores of Experimental and Control groups in Section Domain of SP

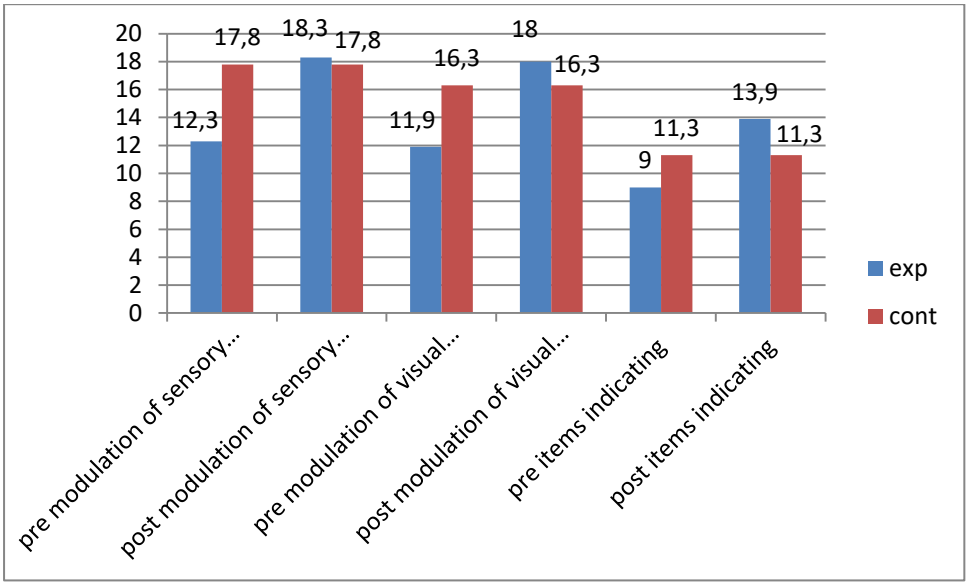
Section	Group	Mean rank	Sum of rank	U score	Sig(2tailed)
Auditory processing	Exp	13.70	137.00	18.00	.**015**
	Con	7.30	73.00		
Visual processing	Exp	9.95	99.50	44.50	.675
	Con	11.05	110.50		
Touch processing	Exp	13.10	131.00	24.00	**.049**
	Con	7.90	79.00		
Multisensory processing	Exp	12.60	126.00	29.00	.111
	Con	8.40	84.00		
Oral sensory sensitivity	Exp	13.50	135.00	20.00	**.023**
	Con	7.50	75.00		
modulation of movement affecting activity level	Exp	11.55	115.50	39.50	.423
	Con	9.45	94.50		
Emotional /social responses	Exp	11.10	111.00	44.00	.649
	Con	9.90	99.00		
Behavioral outcomes of sensory processing	Exp	12.90	129.00	26.00	.067
	Con	8.10	81.00		

The table 5.4 shows between group comparison demonstrated a significant difference in Auditory processing, P is 0.01<0.05, touch processing p is 0.049<0.05 and oral sensory processing p is 0.023<0.05 as expected sensory integration therapy brings these variables to an optimum level. The scores of those section in which homogeneity was not present at pre test ,have been compared using the following graph 5.

Graph 5 Comparison of pre test and post test scores of section domain of SP.



Graph 6 comparison between experimental and control group scores [pre test and post test scores on section domain of SP



These graph reveal that in all sensory section there is a higher improvement experimental group than in control group. Higher values in sensory profile indicate low sensory processing problem.

Table 6.1 comparison between pre and post test scores of factor component of experimental group in SP

factor	pre		post		Z score	sig
Sensory seeking	mean	SD	mean	SD	-2.701	**.007**
	49.30	20.05	75.60	6.88		
Emotionally reactive	48.20	18.52	68.50	60.00	-2.703	**.007**
Low endurance or tone	27.10	10.46	41.00	36.00	-2.654	**.008**
Oral sensory sensitivity	30.80	11.65	40.10	34.00	-2.552	**.011**
Inattention/ distractibility	20.20	6.124	26.70	5.57	-1.989	**.047**
Poor registration	26.30	11.37	37.70	2.16	-2.809	**.005**
Sensory sensitivity	13.80	4.75	18.40	1.57	-2.673	**.008**
Sedentary	12.60	5.10	16.50	1.58	-2.170	**.030**
Fine motor/perceptual	9.30	1.82	12.20	12.20	-2.687	**.007**

The above table shows descriptive statistics of factor component in sensory profile . The result shows that there is significant difference in all the factor component of in the experimental group

Table 6.2comparison between pre and post test scores of factor component on control group in SP

Factor	pre		post		Z score	sig
Sensory seeking	mean	SD	mean	SD	**.**000	1.00
	68.80	9.354	68.60	9.35		
Emotionally reactive	62.90	10.58	63.20	10.57	-1.342	.180
Low endurance or tone	42.00	2.160	42.00	2.16	.000	.317
Oral sensory sensitivity	34.40	9.879	37.50	5.70	-1.000	.317
Inattention/ distractibility	23.20	6.924	24.80	5.49	-1.000	.317
Poor registration	31.60	5.621	32.50	6.04	-1.000	.317
Sensory sensitivity	15.30	4.522	14.30	5.77	-1.000	.317
Sedentary	14.80	2.936	14.00	4.02	-531	.593
Fine motor/perceptual	9.900	3.212	9.90	3.21	.000	1.00

The above table shows descriptive statistics of factor component in sensory profile and there is no significant difference in the control group

Table 6.3 **Comparison between Pre Test Scores of Experimental and Control Groups on Components of Factor Domain in SP**

Outcome measure	Group	Mean Rank	Sum of rank	U score	Sig(2tailed)
Sensory seeking	experimental	7.75	77.50	22.50	**.037**
	control	13.25	132.50		
Emotionally reactive	Experimental	7.95	79.50	24.50	**.053**
	control	13.05	130.50		
Low endurance or tone	experimental	6.00	60.00	5.000	**.001**
	control	15.00	150.00		
Oral sensory sensitivity	experimental	9.70	97.00	42.00	.544
	control	11.30	113.00		
Inattention/ distractibility	experimental	8.75	87.50	32.50	.184
	control	12.25	122.50		
Poor registration	experimental	9.60	96.00	41.00	.494
	control	11.40	114.00		
Sensory sensitivity	experimental	9.35	93.50	38.50	.381
	control	11.65	116.50		
Sedentary	experimental	9.15	91.50	36.50	.303
	Control	11.85	118.50		
Fine motor/perceptual	experimental	9.30	93.00	38.00	.351
	control	11.70	117.00		

The above table shows there are significant differences in the pre-test of factor domain. Sensory seeking (p is 0.037 <0.05), Emotionally reactive (p is 0.053<0.05),Low endurance or tone(p is 0.001<0.05). This indicating these factors cannot be compared in post test .other factor of sensory profile can be compared at post test level.

Table 6.4 Comparison between Post Test Scores of Experimental and Control Group on Components of Factor Domain in SP

Outcome measure	Group	N	Mean Rank	Sum of rank	U score	Sig(2tailed)
Oral sensory sensitivity	Experimental	10	11.90	119.00	36.00	.288
	Control	10	9.10	91.00		
Inattention/ distractibility	Experimental	10	11.75	117.50	37.50	.337
	Control	10	9.25	92.50		
Poor registration	Experimental	10	13.45	134.50	20.50	**.024**
	Control	10	7.55	75.50		
Sensory sensitivity	Experimental	10	12.85	128.50	26.50	.075
	Control	10	8.15	81.50		
Sedentary	Experimental	10	12.15	121.50	33.50	.205
	Control	10	8.85	88.50		
Fine motor/perceptual	Experimental	10	12.65	126.50	28.50	.100
	Control	10	8.35	83.50		

The above table shows there is significant differences in the post –test of poor registration (p is 0.024 <0.05). there is no other significant differences in any other component .the score of those factor in which the homogeneity was not present at the pres test , have been compared using the following graph 7.

Graph 7 comparisons between pre test scores of experimental and control groups on factor component

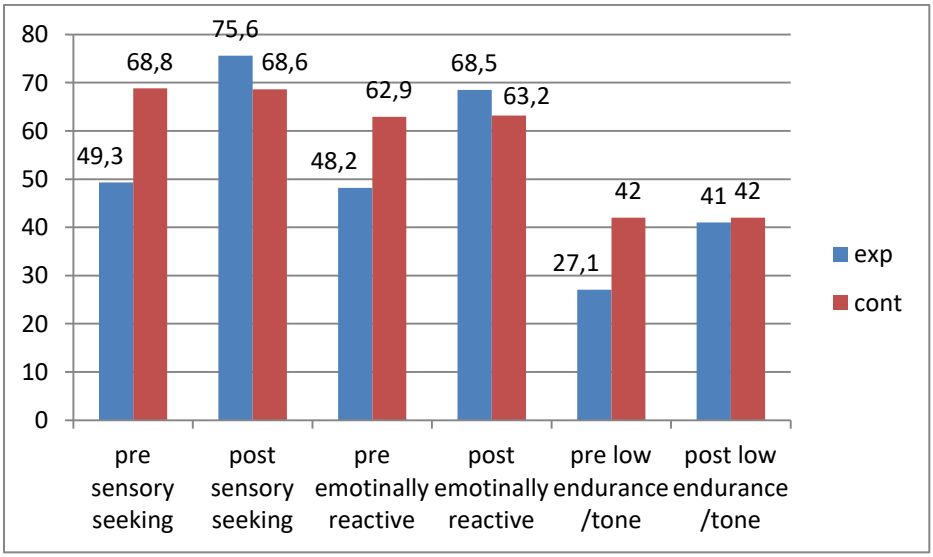


Table 7.1 **comparison between pre and post test score of sensory profile: quadrant component on experimental**

Outcome measure	pre		post		Z score	sig
Registration	mean	SD	mean	SD	-2.803	**.005**
	49.30	18.82	70.00	11.52		
Seeking	89.10	34.11	115.40	10.82	-2.807	**.005**
Sensitivity	67.40	25.69	87.70	5.16	-2.293	**.022**
avoiding	101.20	28.30	123.10	9.31	-2.654	**.008**

Graph 8 **Graphical representation of Comparison of Components of quadrant in SP within the experimental Group**

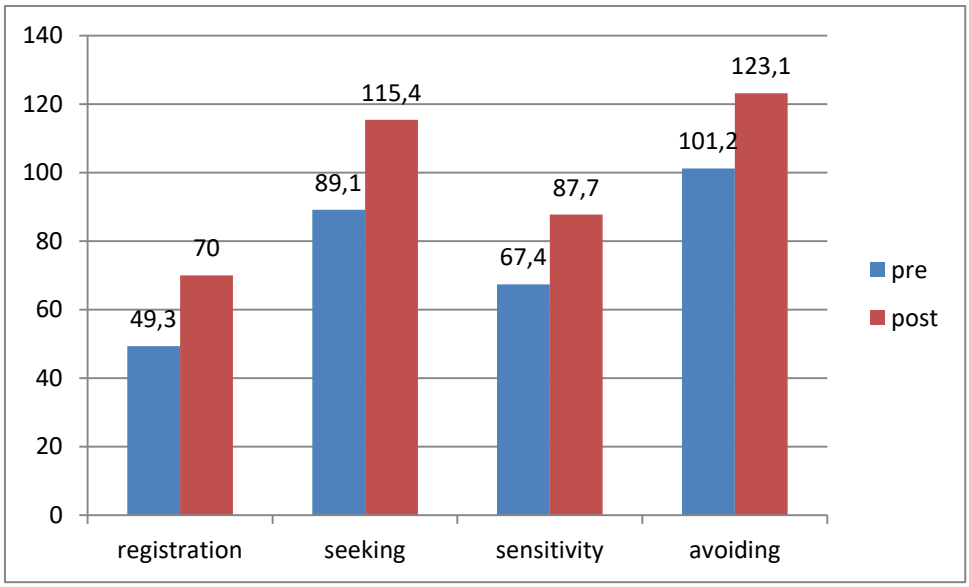


Table 7.1 &graph 8 .The above table shows statistics of sensory profile among the factor component of experimental group and there is significant difference in all the component of quadrant.

Table 7.2 comparison of pre and post test scores of sensory profile: quadrant component on control

Outcome measure	pre		post		Z score	sig
Registration	mean	SD	mean	SD	-1.000	.317
	68.40	5.01	62.00	19.94		
Seeking	98.80	32.05	100.20	32.46	-1.000	.317
Sensitivity	70.00	23.65	70.00	23.65	.000	1.00
avoiding	105.30	42.65	118.20	19.38	-1.342	.180

Graph 9 pre and post scores of Comparison of Components of quadrant in SP within the control Group

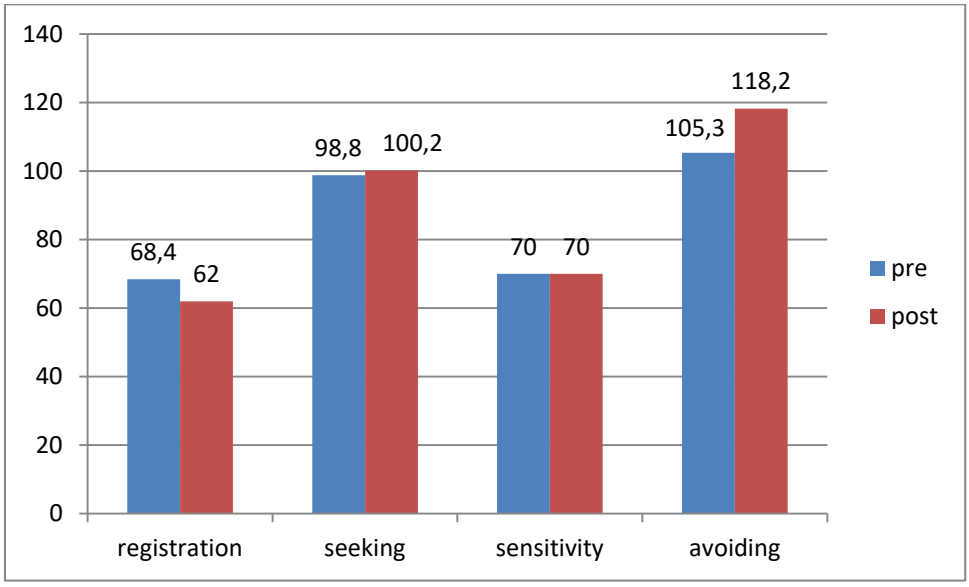


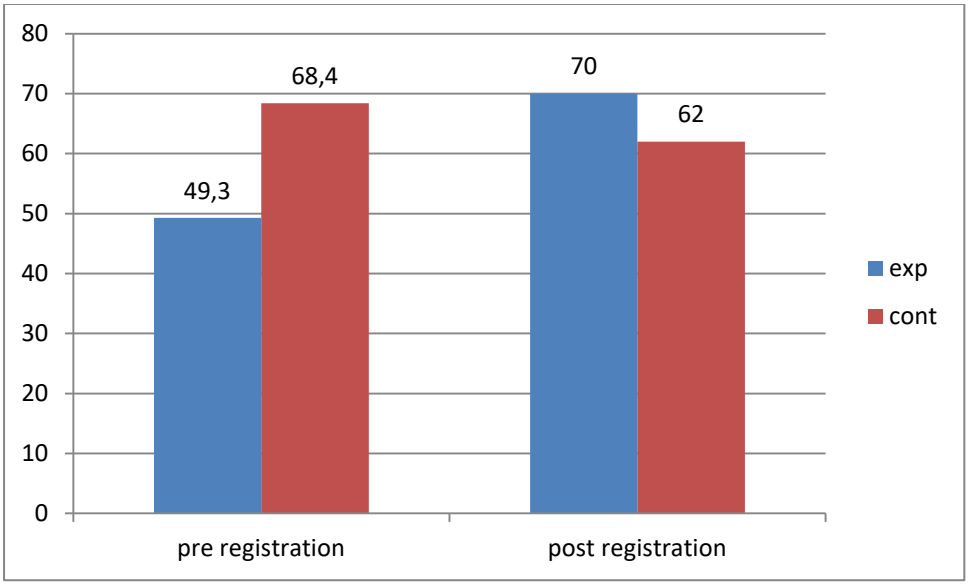
Table 7.2&graph 9 The above table shows descriptive statistics of sensory profile among the factor component of control group and there is no significant difference in any of the component of quadrant.

Table 7.3 Comparison between pre and post test scores of experimental and control groups on components of quadrant domain in SP

Test	Outcome measure	Group	Mean Rank	Sum of rank	U score	Sig(2tailed)
Pretest	Registration	experimental	6.70	67.00	12.00	**.004**
		control	14.30	143.00		
	Seeking	experimental	9.80	98.00	43.00	.597
		control	11.20	112.00		
	Sensitivity	experimental	10.00	100.00	45.00	.705
		control	11.00	110.00		
	Avoiding	experimental	9.50	95.00	40.00	.449
		control	11.50	115.00		
Posttest	Registration	experimental	10.85	108.50	46.50	.791
		control	10.15	101.50		
	Seeking	experimental	11.75	117.50	37.50	.343
		control	9.25	92.50		
	Sensitivity	experimental	13.45	134.50	20.50	**.025**
		control	7.55	75.50		
	Avoiding	experimental	10.00	100.00	45.00	**.**705
		control	11.00	110.00		

There is significant differences in pre-test component of registration (p is 0.004<0.05). the score of those quadrant in which the homogeneity was not present at the pres test , have been compared using the following graph 10.

Graph 10 **comparison of pre and post test scores of sensory profile: quadrant**



This graph reveals that there is higher improvement in experimental group than control group; higher values in sensory profile indicate low sensory processing problems.

RESULTS

Results of analysis of children sleep habit questionnaire

- Within group comparison of experimental group shows that there is significant difference in the pre and post test of experimental group p is **.005**, when comparing with pre and post test scores of control group p is .400. on children sleep habit questionnaire. It reveal that sleep disturbance has reduced markedly in experimental group.(table 2)
- Between group comparison of pre test shows there is no significant difference p is.568 in the experimental and control group on children sleep habit questionnaire.
- Comparison of post test scores go shows there is significant differences p is **.000** between experimental and control group. indicating the improvement made by experimental group. (Table 2.2)

Results of analysis of sleep quality

- Within group comparison of experimental group shows that there is significant difference in the pre and post test p is **.004**, when comparing with pre and post test scores of control group p is .083. on VAS-child sleep quality ,reveal that sleep quality has improved in experimental group .(Table 3.1)
- Between group comparison of pre test go shows there is no significant difference p is .661 in the experimental and control group (Table 3.2)
- Comparison of post scores of experimental and control shows there is significant difference p is **.000,** reveal that marked improvement in child sleep quality (Table 3.2).

Results of analysis of parent's satisfaction

- Within group comparison of experimental group shows that there is significant difference in the pre and post test p is **.004**, when comparing

with pre and post test scores of control group p is .180 on VAS-parents satisfaction ,reveal that parents satisfaction has improved in experimental group. (Table 4.1)

- Between group comparison of pre test shows there is significant difference in both experimental p is.**000** and control group p is **.038** ,it indicate that there is parent satisfaction were already exit (Table 4.2).

Results of analysis of sensory profile

Section

- Within group comparison of pre and post test score of experimental group shows significant differences p is<.05 when comparing with pre and post test scores of control group p is >.05.it reveals that there is sensory issues has reduced for experimental group. (Table 5.1a, Table 5.1b)
- Between group comparison of pre test shows there is significant difference in the experimental and control group on visual processing p is.011,sensory processing related to tone /endurance p is.024,modulation related to body position and movement p is .024, modulation of sensory input affecting emotional response p is .016, modulation of visual input affecting emotional response and activity level p is .007,items indicating threshold p is .051,indicating these section cannot be compared in post test. Other section of sensory profile can be compared at post test level. (Table 5.2a, Table 5.2b).
- Between experimental and control comparison of post test there is significant differences in auditory processing p is .015,touch processing p is .049,oral sensory sensitivity p is .023 on section component (Table 5.4a, Table 5.4b).

Factor

- Within group comparison of pre and post test score of experimental group shows significant differences p is<.05 when comparing with pre and post test scores of control group p is >.05.it reveals that there is sensory issues has reduced for experimental group (Table 6.1, Table 6.2)
- Comparison between experimental and control group pre test scores shows there is significant differences in sensory seeking p is .037,emotionally reactive p is 0.053,low endurance or tone p is .001, indicating these sections cannot be compared in post test. Other factors of sensory profile can be compared at post test level (Table 6.3)
- Comparison between experimental and control group post test score shows there is significance differences p is <.05 only in poor registration of factor domain of sensory profile. The rest of the components have not shown differences (Table 6.4).

Quadrant

- Within group comparison of pre and post test score of experimental group shows significant differences p is<.05 when comparing with pre and post test scores of control group p is >.05.it reveals that there is sensory issues has reduced (Table 7.1)
- Comparison between experimental and control group pre test scores shows there is significant differences in registration p is .004this indicating this score cannot be compared in post score ,other quadrant profile can be compared at the post level (Table 7.3)
- Comparison between experimental and control group post test scores shows there is significant differences p is .05 on sensitivity quadrant alone (Tale 7.3).

DISCUSSION

DISCUSSION

Sleep is an occupational task in which all children are expected to participate. Lack of or disturbed sleep leads to secondary behavioural problems such as irritability, lack of attention, and low learning abilities.

Sleep problems have been frequently identified in children with autism spectrum disorders [1]. Previous studies are not adequate to generalize the relationship between SPD and sleep problems and the effect of SI on sleep behaviours. Therefore, this study was done to find the impact of sensory integration on sleep disturbance among children with sensory processing disorder and for this purpose 20 SPD children with sleep disturbance were assigned according to convenience into the experimental and control group. There were 8 boys and 2 girls in the experimental group and 8 boys and 2 girls in the control group. The mean age of experimental group of children was 3.95 and that of control group was 3.94.

The children in experimental group underwent regular occupational therapy with sensory integration therapy and those in control group received regular occupational therapy with a sleep schedule. Since the experimental and the control group were divided according to the convenient sampling, statistical analysis of groups for pretest was done and found to be significant. It indicates the homogeneity of the groups. Thus the groups were comparable after intervention period.

Effect of Sensory integration on sleep

The CHSQ was used to measure the sleep disturbance in children with SPD. The results reveal that [Table 2.2, graph 2.1],the pre test of experimental and control group revealed non significance. Results of post intervention for experimental group with calming based SI therapy,[Table 2.1], reveals that there is significant difference in the post test of experimental group (0.005). This shows that there is reduction of sleep disturbance following calming based SI therapy. Whereas the control group did not reveal any significant results (0.400). This result is consistent with the findings of the study by James Williamson et al which says that the role of Occupational therapy in the calming techniques of sensory integration plays a significant role in reducing sleep behaviours[17.]

Visual Analogue Scale was used to measure the children's sleep quality. A scale of 10 to 100, which was given to the parents of the children with SPD. The scale was given both for pre and post test and parents were asked to rate their child's sleep quality. The results of the

pre test [Table 3.2], revealed that there is no significance differences (0.661), which showed the poor sleep quality of the children of both group. Whereas the post test revealed a p value of 0.000, which shows that there is significant improvement in the sleep quality post the intervention of calming based SI therapy, as rated by the parents in experimental group.

Parents satisfaction in children's sleep quality was measured with Visual Analogue Scale. The results in Table 4.1 reveals there is significant difference in the experimental group which shows the satisfaction of parents in children's sleep quality (0.004) as compared to the control group which revealed non significance (0.180) .The results mentioned above provide a clear evidence that SI therapy had an positive impact on sleep of the children with SPD

Effect of Sensory Integration of Sensory Processing skills:

The Sensory Profile by Winnie Dunn, is a 125-question caregiver-completed profile that reports the frequency of the person's response to various sensory experiences (Dunn, 1999). On the Sensory Profile, lower scores indicate greater SPD symptoms.

The sensory profile was used to measure the sensory processing skills of the children. It has three components: section, factor and quadrant. Therapy program based on sensory integration show a definite changes in sensory processing skills. Such modulation will have an indirect effect on sleep , this was evidenced through tables 5.1a,b,6.3&7.2 these tables explain that the experimental group which had undergone SI therapy atleast 4 times a day and specific SI based calming techniques have shown improvement in sensory processing skills. Such an improvement could not be noted in control group.

Schochat , tzischin –sky ,and engal – yeger(2009) have proposed that children with sleep problems easily over aroused by sensory stimuli .and also in typically developing children tactile sensitivity was reported to be a significant predictor of sleep disturbance .shani-adhir et.,al(2009) found that sensory hypersensitivity correlated with lower sleeping quality in children with atopic dermatitis .all the above mentioned researchers have clearly stated the conclusion that SI therapy in essential for facilitating good sleep quality in children with SPD ,which is statistically proven in this current study.

Milner et.,at(2001), shani-adhir et.,al(2009) and many other author noted that good sleepers can initiate and maintain sleep by disengaging from the environment is an automatic and effortless manner and can successfully gate irrelevant stimuli for children with sensory

modulation disorder. Sleep becomes a more effortful process with difficulty in disengaging from the over arousing sensory environment. Thus intervention based on SI is required to develop regular sleep patterns ,which also prevents secondary behavioural problems from occurring .

EFFECT OF SLEEP SCHEDULE ON SLEEP:

Sleep scheduling was followed as the intervention for control group. It includes advising parents on maintaining proper sleep and nap timings, following a light carbohydrate meal prior to sleep instead of heavy meals, avoiding gadgets prior to sleep timing and avoiding stimulatory plays prior to sleep. Although proper sleep scheduling was followed for the children in the control group, the post tests revealed that there is non significance. This indicates that sleep scheduling alone as an intervention cannot benefit the children in reducing sensory issues or improving sleep quality.

SLEEP DISTURBANCE AND SLEEP LOG TO MEASURE SLEEP HABIT BEFORE AND AFTER INTERVENTION:

All the parents of the included children filled and gave the sleep log. The frequency of sleep cycle was measured using sleep log. Children with sleep disturbance, usually slept late in the night. They also indicated waking up in between during sleep which hindered their overall sleep habit. Parents reported that frequency of waking up in between sleep was more accompanied by irritability and crying. Due to this the children were found to return to sleep very late and therefore this affected their waking time. Children with sleep disturbance were found to wake up in late mornings and this affected their routine for the entire day. Some parents also reported that children who sleep late after waking up in the night, also wake up early in the morning, and this affected their overall sleep behaviour.

For the experimental group, the changes were noted on adequate sleep behaviour, reduction in the night time awakenings. A child who wakes up three to four times per night was reported as to have better sleep behaviour and only once night time awakening. The children were also able to return to complete sleep with better quality and were able to wake up in the morning without difficulty. Children were also able to function throughout the day due to adequate sleep the previous night.

For the control group, the children were not able to achieve a better sleep quality although parents reported a reduction in night time awakenings. The children slept late and also woke up early, but the number of times of night time awakenings reduced as of before.

Therefore for the further betterment it can be suggested to combine both the intervention of sleep scheduling as well as calming based SI therapy for further reduction of sensory issues and for better sleep quality for children with SPD.

CONCLUSION

CONCLUSION

- Sensory integration therapy has an effect in sleep disturbance for children with SPD.
- Treatment in combination with sleep schedule and sensory integration therapy will be a better choice for children with SPD.
- Occupational therapists can teach calming based sensory integration therapy with sleep schedule to the parents of children with SPD to achieve adequate sleep.

LIMITATIONS AND RECOMMENDATIONS

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LIMITATIONS:

- The subjects for the intervention phase were assigned using convenient sampling and the size was too small to generalize the results.
- Involvement of mother is an important factor in maintaining sleep log. It was difficult to sort complete co-operation from mothers.

RECOMMENDATION:

- Further investigation should include large sample size.
- Correlation studies between sleep disturbance and sensory integration dysfunction.
- Comparison between three interventions (sensory integration, sleep schedule, sensory integration + sleep schedule) can add an extensive knowledge into this area of research.

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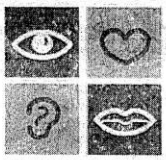
APPENDIX



SENSORY PROFILE

Winnie Dunn, Ph.D., OTR, FAOTA

Caregiver Questionnaire

Child's Name: _ Birth Date: _____ Date: _____

Completed by: _ _____ Relationship to Child: _____

Service Provider's Name: _____ Discipline: _____

INSTRUCTIONS

Please check the box that best describes the frequency with which your child does the following behaviors. Please answer all of the statements. If you are unable to comment because you have not observed the behavior or believe that it does not apply to your child, please draw an X through the number for that item. Write any comments at the end of each section. Please do not write in the Section Raw Score Total row.

Use the following key to mark your responses:

ALWAYS	When presented with the opportunity, your child always responds in this manner, 100% of the time.
FREQUENTLY	When presented with the opportunity, your child frequently responds in this manner, about 75% of the time.
OCCASIONALLY	When presented with the opportunity, your child occasionally responds in this manner, about 50% of the time.
SELDOM	When presented with the opportunity, your child seldom responds in this manner, about 25% of the time.
NEVER	When presented with the opportunity, your child never responds in this manner, 0% of the time.

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Sensory Processing

Item			A. Auditory Processing	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
?	L	1	Responds negatively to unexpected or loud noises (for example, cries or hides at noise from vacuum cleaner, dog barking, hair dryer)					
?	L	2	Holds hands over ears to protect ears from sound					
?	L	3	Has trouble completing tasks when the radio is on					
?	L	4	Is distracted or has trouble functioning if there is a lot of noise around					
?	L	5	Can't work with background noise (for example, fan, refrigerator)					
?	H	6	Appears to not hear what you say (for example, does not "tune-in" to what you say, appears to ignore you)					
?	H	7	Doesn't respond when name is called but you know the child's hearing is OK					
?	H	8	Enjoys strange noises/seeks to make noise for noise's sake					
			Section Raw Score Total					

Comments

Item			B. Visual Processing	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
👁	L	9	Prefers to be in the dark					
👁	L	10	Expresses discomfort with or avoids bright lights (for example, hides from sunlight through window in car)					
👁	L	11	Happy to be in the dark					
👁	L	12	Becomes frustrated when trying to find objects in competing backgrounds (for example, a cluttered drawer)					
👁	L	13	Has difficulty putting puzzles together (as compared to same age children)					
👁	L	14	Is bothered by bright lights after others have adapted to the light					
👁	L	15	Covers eyes or squints to protect eyes from light					
👁	H	16	Looks carefully or intensely at objects/people (for example, stares)					
👁	H	17	Has a hard time finding objects in competing backgrounds (for example, shoes in a messy room, favorite toy in the "junk drawer")					
			Section Raw Score Total					

Comments

	Item		C. Vestibular Processing	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
→	L	18	Becomes anxious or distressed when feet leave the ground					
→	L	19	Dislikes activities where head is upside down (for example, somersaults, roughhousing)					
→	L	20	Avoids playground equipment or moving toys (for example, swing set, merry-go-round)					
→	L	21	Dislikes riding in a car					
→	L	22	Holds head upright, even when bending over or leaning (for example, maintains a rigid position/posture during activity)					
→	L	23	Becomes disoriented after bending over sink or table (for example, falls or gets dizzy)					
→	H	24	Seeks all kinds of movement and this interferes with daily routines (for example, can't sit still, fidgets)					
→	H	25	Seeks out all kinds of movement activities (for example, being whirled by adult, merry-go-rounds, playground equipment, moving toys)					
→	H	26	Twirls/spins self frequently throughout the day (for example, likes dizzy feeling)					
→	H	27	Rocks unconsciously (for example, while watching TV)					
→	H	28	Rocks in desk/chair/on floor					
			Section Raw Score Total					

Comments

Item			D. Touch Processing	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
	L	29	Avoids getting "messy" (for example, in paste, sand, finger paint, glue, tape)					
	L	30	Expresses distress during grooming (for example, fights or cries during haircutting, face washing, fingernail cutting)					
	L	31	Prefers long-sleeved clothing when it is warm or short sleeves when it is cold					
	L	32	Expresses discomfort at dental work or toothbrushing (for example, cries or fights)					
	L	33	Is sensitive to certain fabrics (for example, is particular about certain clothes or bedsheets)					
	L	34	Becomes irritated by shoes or socks					
	L	35	Avoids going barefoot, especially in sand or grass					
	L	36	Reacts emotionally or aggressively to touch					
	L	37	Withdraws from splashing water					
	L	38	Has difficulty standing in line or close to other people					
	L	39	Rubs or scratches out a spot that has been touched					
	H	40	Touches people and objects to the point of irritating others					
	H	41	Displays unusual need for touching certain toys, surfaces, or textures (for example, constantly touching objects)					
	H	42	Decreased awareness of pain and temperature					
	H	43	Doesn't seem to notice when someone touches arm or back (for example, unaware)					
	H	44	Avoids wearing shoes; loves to be barefoot					
	H	45	Touches people and objects					
	H	46	Doesn't seem to notice when face or hands are messy					
			Section Raw Score Total					

Comments

Item			E. Multisensory Processing	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
		47	Gets lost easily (even in familiar places)					
		48	Has difficulty paying attention					
	L	49	Looks away from tasks to notice all actions in the room					
	H	50	Seems oblivious within an active environment (for example, unaware of activity)					
	H	51	Hangs on people, furniture, or objects even in familiar situations					
	H	52	Walks on toes					
	H	53	Leaves clothing twisted on body					
			Section Raw Score Total					

Comments

Item			F. Oral Sensory Processing	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
	L	54	Gags easily with food textures or food utensils in mouth					
	L	55	Avoids certain tastes or food smells that are typically part of children's diets					
	L	56	Will only eat certain tastes (list:)					
	L	57	Limits self to particular food textures/temperatures (list:)					
	L	58	Picky eater, especially regarding food textures					
	H	59	Routinely smells nonfood objects					
	H	60	Shows strong preference for certain smells (list:)					
	H	61	Shows strong preference for certain tastes (list:)					
	H	62	Craves certain foods (list:)					
	H	63	Seeks out certain tastes or smells (list:)					
	H	64	Chews or licks on nonfood objects					
	H	65	Mouths objects (for example, pencil, hands)					
			Section Raw Score Total					

Comments

Modulation

Item			G. Sensory Processing Related to Endurance/Tone	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
		66	Moves stiffly					
	H	67	Tires easily, especially when standing or holding particular body position					
	H	68	Locks joints (for example, elbows, knees) for stability					
	H	69	Seems to have weak muscles					
	H	70	Has a weak grasp					
	H	71	Can't lift heavy objects (for example, weak in comparison to same age children)					
	H	72	Props to support self (even during activity)					
→	H	73	Poor endurance/tires easily					
→	H	74	Appears lethargic (for example, has no energy, is sluggish)					
			Section Raw Score Total					

Comments

Item			H. Modulation Related to Body Position and Movement	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
		75	Seems accident-prone					
		76	Hesitates going up or down curbs or steps (for example, is cautious, stops before moving)					
	L	77	Fears falling or heights					
	L	78	Avoids climbing/jumping or avoids bumpy/uneven ground					
	L	79	Holds onto walls or banisters (for example, clings)					
	H	80	Takes excessive risks during play (for example, climbs high into a tree, jumps off tall furniture)					
	H	81	Takes movement or climbing risks during play that compromise personal safety					
	H	82	Turns whole body to look at you					
	H	83	Seeks opportunities to fall without regard to personal safety					
	H	84	Appears to enjoy falling					
			Section Raw Score Total					

Comments

Item			I. Modulation of Movement Affecting Activity Level	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
	L	85	Spends most of the day in sedentary play (for example, does quiet things)					
	L	86	Prefers quiet, sedentary play (for example, watching TV, books, computers)					
	L	87	Seeks sedentary play options					
	L	88	Prefers sedentary activities					
	H	89	Becomes overly excitable during movement activity					
	H	90	"On the go"					
	H	91	Avoids quiet play activities					
			Section Raw Score Total					

Comments

Item			J. Modulation of Sensory Input Affecting Emotional Responses	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
		92	Needs more protection from life than other children (for example, defenseless physically or emotionally)					
	L	93	Rigid rituals in personal hygiene					
	H	94	Is overly affectionate with others					
	H	95	Doesn't perceive body language or facial expressions (for example, unable to interpret)					
			Section Raw Score Total					

Comments

Item			K. Modulation of Visual Input Affecting Emotional Responses and Activity Level	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
👁	L	96	Avoids eye contact					
👁	H	97	Stares intensively at objects or people					
👁	H	98	Watches everyone when they move around the room					
👁	H	99	Doesn't notice when people come into the room					
			Section Raw Score Total					

Comments

Behavior and Emotional Responses

Item			L. Emotional/Social Responses	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
♡		100	Seems to have difficulty liking self (for example, low self-esteem)					
♡		101	Has trouble "growing up" (for example, reacts immaturely to situations)					
♡		102	Is sensitive to criticisms					
♡		103	Has definite fears (for example, fears are predictable)					
♡		104	Seems anxious					
♡		105	Displays excessive emotional outbursts when unsuccessful at a task					
♡		106	Expresses feeling like a failure					
♡		107	Is stubborn or uncooperative					
♡		108	Has temper tantrums					
♡		109	Poor frustration tolerance					
♡		110	Cries easily					
♡		111	Overly serious					
♡		112	Has difficulty making friends (for example, does not interact or participate in group play)					
♡		113	Has nightmares					
♡		114	Has fears that interfere with daily routine					
♡		115	Doesn't have a sense of humor					
♡		116	Doesn't express emotions					
			Section Raw Score Total					

Comments

7

Item			M. Behavioral Outcomes of Sensory Processing	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
		117	Talks self through tasks					
		118	Writing is illegible					
		119	Has trouble staying between the lines when coloring or when writing					
		120	Uses inefficient ways of doing things (for example, wastes time, moves slowly, does things a harder way than is needed)					
	L	121	Has difficulty tolerating changes in plans and expectations					
	L	122	Has difficulty tolerating changes in routines					
			Section Raw Score Total					

Comments

Item			N. Items Indicating Thresholds for Response	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
		123	Jumps from one activity to another so that it interferes with play					
	H	124	Deliberately smells objects					
	H	125	Does not seem to smell strong odors					
			Section Raw Score Total					

Comments

FOR OFFICE USE ONLY

ICON KEY	
	Auditory
	Visual
	Activity Level
	Taste/Smell
	Body Position
	Movement
	Touch
	Emotional/Social

THRESHOLD KEY	
	Neither low nor high
L	Low
H	High

SCORE KEY	
1	Always
2	Frequently
3	Occasionally
4	Seldom
5	Never

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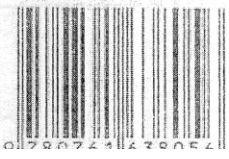


Child's Sleep Habits
(Preschool and School-Aged)
(Abbreviated Version)

Coding

The following statements are about your child's sleep habits and possible difficulties with sleep. Think about the past week in your child's life when answering the questions. If last week was unusual for a specific reason (such as your child had an ear infection and did not sleep well or the TV set was broken), choose the most recent typical week. Answer USUALLY if something occurs **5 or more times** in a week; answer SOMETIMES if it occurs **2-4 times** in a week; answer RARELY if something occurs **never or 1 time** during a week. Also, please indicate whether or not the sleep habit is a problem by circling "Yes," "No," or "Not applicable (N/A)".

Bedtime

Write in child's bedtime: _____

		3 Usually (5-7)	2 Sometimes (2-4)	1 Rarely (0-1)	Problem?		
1)	Child goes to bed at the same time at night (R)	☐	☐	☐	Yes	No	N/A
2)	Child falls asleep within 20 minutes after going to bed (R)	☐	☐	☐	Yes	No	N/A
3)	Child falls asleep alone in own bed (R)	☐	☐	☐	Yes	No	N/A
4)	Child falls asleep in parent's or sibling's bed	☐	☐	☐	Yes	No	N/A
5)	Child needs parent in the room to fall asleep	☐	☐	☐	Yes	No	N/A
6)	Child struggles at bedtime (cries, refuses to stay in bed, etc.)	☐	☐	☐	Yes	No	N/A
7)	Child is afraid of sleeping in the dark	☐	☐	☐	Yes	No	N/A
8)	Child is afraid of sleep alone	☐	☐	☐	Yes	No	N/A

Sleep Behavior

Child's usual amount of sleep each day: _____ hours and _____ minutes
(combining nighttime sleep and naps)

		3 Usually (5-7)	2 Sometimes (2-4)	1 Rarely (0-1)	Problem?		
9)	Child sleeps too little	☐	☐	☐	Yes	No	N/A
10)	Child sleeps the right amount (R)	☐	☐	☐	Yes	No	N/A
11)	Child sleeps about the same amount each day (R)	☐	☐	☐	Yes	No	N/A
12)	Child wets the bed at night	☐	☐	☐	Yes	No	N/A
13)	Child talks during sleep	☐	☐	☐	Yes	No	N/A
14)	Child is restless and moves a lot during sleep	☐	☐	☐	Yes	No	N/A
15)	Child sleepwalks during the night	☐	☐	☐	Yes	No	N/A
16)	Child moves to someone else's bed during the night (parent, brother, sister, etc.)	☐	☐	☐	Yes	No	N/A
17)	Child grinds teeth during sleep (your dentist may have told you this)	☐	☐	☐	Yes	No	N/A
18)	Child snores loudly	☐	☐	☐	Yes	No	N/A

CSHQ Abbreviated

Coding

Sleep Behavior (continued)

		3 Usually (5-7)	2 Sometimes (2-4)	1 Rarely (0-1)	Problem?		
19)	Child seems to stop breathing during sleep	☐	☐	☐	Yes	No	N/A
20)	Child snorts and/or gasps during sleep	☐	☐	☐	Yes	No	N/A
21)	Child has trouble sleeping away from home (visiting relatives, vacation)	☐	☐	☐	Yes	No	N/A
22)	Child awakens during night screaming, sweating, and inconsolable	☐	☐	☐	Yes	No	N/A
23)	Child awakens alarmed by a frightening dream	☐	☐	☐	Yes	No	N/A

Waking During the Night

		3 Usually (5-7)	2 Sometimes (2-4)	1 Rarely (0-1)	Problem?		
24)	Child awakes once during the night	☐	☐	☐	Yes	No	N/A
25)	Child awakes more than once during the night	☐	☐	☐	Yes	No	N/A

Write the number of minutes a night waking usually lasts: _____

Morning Waking/Daytime Sleepiness

Write in the time of day child usually wakes in the morning: _____

		3 Usually (5-7)	2 Sometimes (2-4)	1 Rarely (0-1)	Problem?		
26)	Child wakes up by him/herself **(R)**	☐	☐	☐	Yes	No	N/A
27)	Child wakes up in negative mood	☐	☐	☐	Yes	No	N/A
28)	Adults or siblings wake up child	☐	☐	☐	Yes	No	N/A
29)	Child has difficulty getting out of bed in the morning	☐	☐	☐	Yes	No	N/A
30)	Child takes a long time to become alert in the morning	☐	☐	☐	Yes	No	N/A
31)	Child seems tired	☐	☐	☐	Yes	No	N/A

Child has appeared very sleepy or fallen asleep during the following (check all that apply):

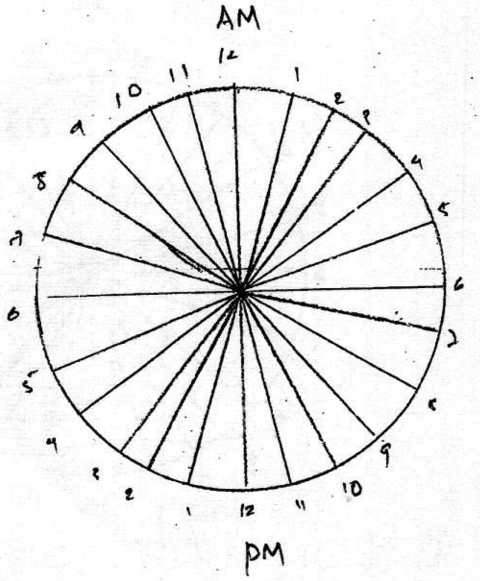
		1 Not Sleepy	2 Very Sleepy	3 Falls Asleep
32)	Watching TV	☐	☐	☐
33)	Riding in car	☐	☐	☐

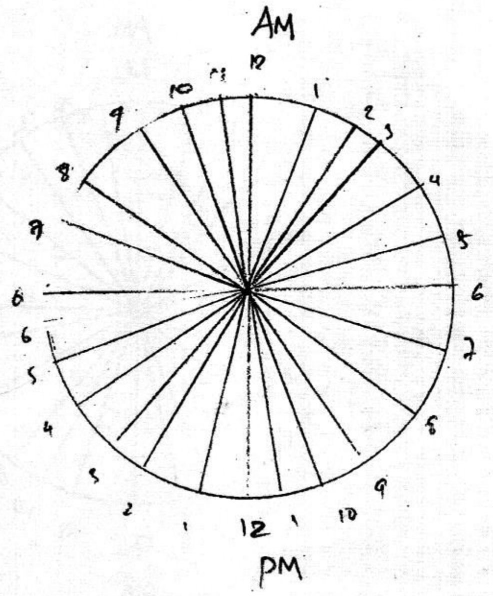
sleep log

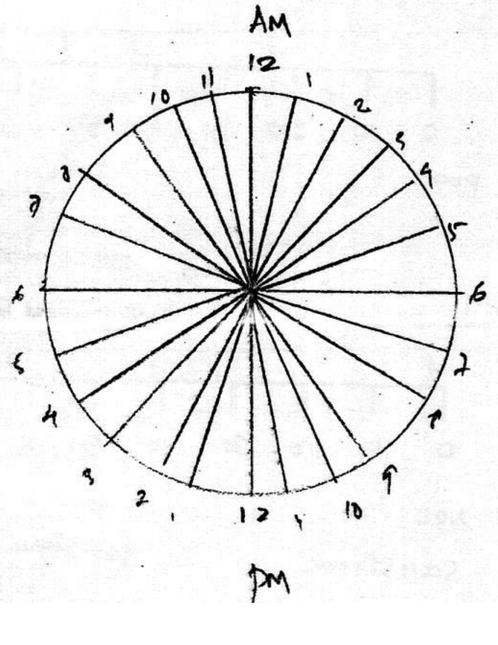
Name

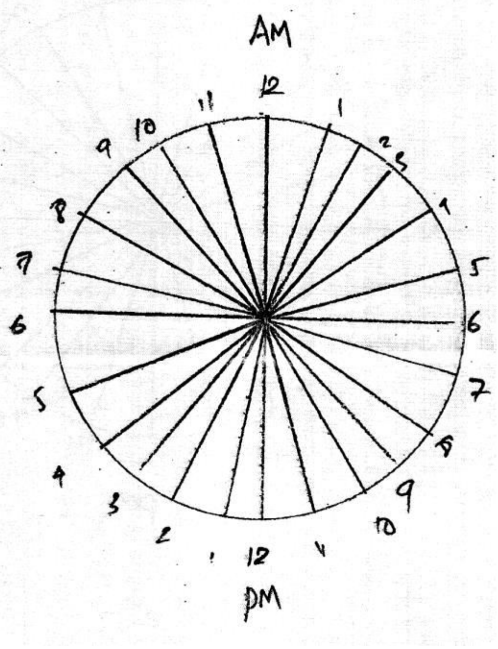
Age

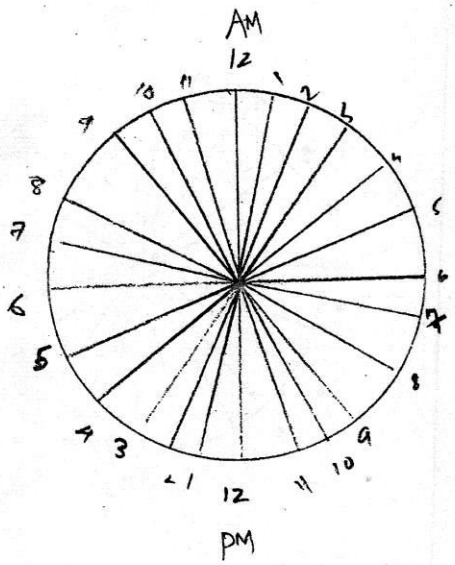
Week

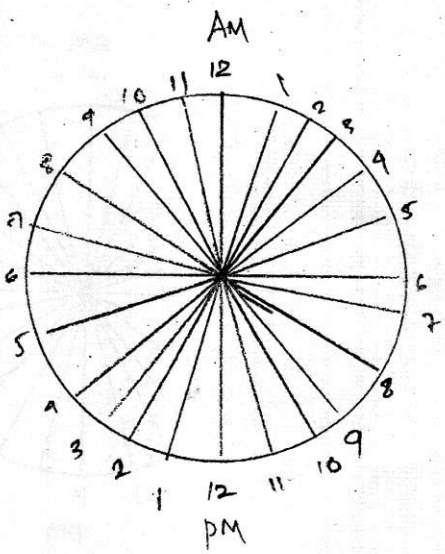




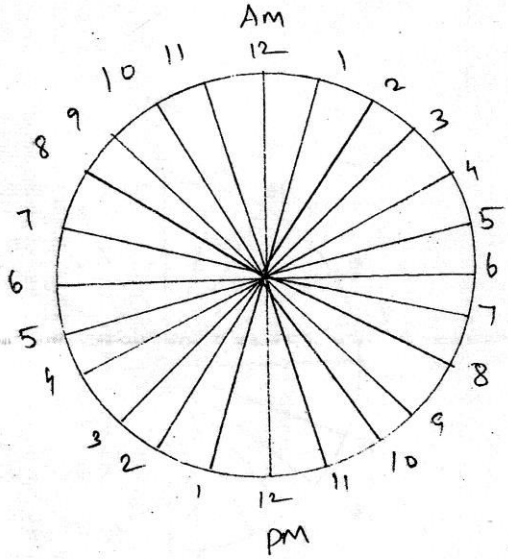




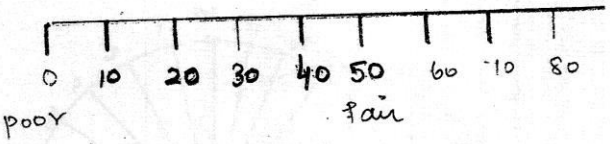




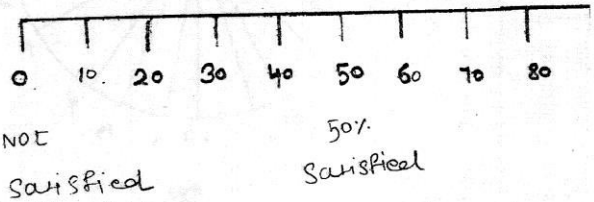
Visual Analogue Scale [V



Child sleep Quality



Parents satisfaction



KMCH ETHICS COMMITTEE
KOVAI MEDICAL CENTER AND HOSPITAL LIMITED

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E-mail : ethics@kmchhospitals.com
EC Reg. No : ECR / 112 / Inst / TN / 2013

Ref: EC/AP/549/07/2017
24.07.2017

APPROVED

To

Dr. K. Rajendran,
Head of the Department – Pediatrics and Neonatalogy,
Kovai Medical Center and Hospital,
Coimbatore-641 014,
Tamilnadu, India.

Dear Dr. K. Rajendran.

The proposal entitled **"Impact of Sensory Integration for Sleep Disturbance among Children with Sensory Processing Disorder"** submitted by **Ms. Deepa.S** under your supervision was reviewed by the Ethics Committee in its meeting held on **22.07.2017** and permission is granted to carry out the study at **Kovai Medical Center and Hospital Ltd, Coimbatore, India.**

Thanking you,

Yours faithfully,

Dr. P. R. Muthuswamy
Chairman, KMCH Ethics Committee

24/7/17

Dr. P. R. MUTHUSWAMY,
MA.,MBA.,FDPM(IIM-A)Ph.D.,
Chairman
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KMCH ETHICS COMMITTEE
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KMCH ETHICS COMMITTEE MEMBERS LIST

S. NO	MEMBER NAME	DESIGNATION	REPRESENTATION	DESIGNATION TO THE INSTITUTION	GENDER
1.	Dr.P.R.Muthuswamy	Principal, Dr.N.G.P Arts & Science College	Chairperson	Chairperson, KMCH Ethics Committee	M
2	Dr. Devdas Madhavan	Consultant Urologist	Member Secretary	Consultant Urologist	M
3	Dr. V.Rajamani	Consultant Rheumatologist & Physician	Clinician	Consultant Rheumatologist & Physician	M
4	Dr.K.Senthilkumar	MD-Pharmacology Pharmacologist	Basic Medical Scientist	None	M
5	Dr. A.N.Murugan	Medical Director	Clinician	Medical Director	M
6	Dr. Sangita S.Mehta	Consultant Pathologist	Clinician	Consultant Pathologist	F
7	Dr. S.Madhavi	Principal	Member	Principal, KMCH college of Nursing	F
8	Dr. K.S.G.Arul Kumaran	Professor	Basic Medical Scientist	Professor, KMCH college of Pharmacy	M
9	Dr. S.Thamil Selvi	Social Worker	Social worker	None	F
10	Mr. C.Tamil Selvan	VP-Materials	convener	VP-Materials	M
11	Mr. T.C.Dinamani	Advocate	Legal Expert	Personnel Manager	M
12	Mr.R.Krishnamoorthy	Priest	Theologist	Priest	M
13	Mr. D.Ramanathan	Office Assistant	Lay person	Office Assistant	M

Dr. P. R. Muthuswamy
Chairman, Ethics Committee

Dr. P. R. MUTHUSWAMY,
MA.,MEA..FDPM(IIM-A)Ph.D.
Chairman
Ethics Committee
Kovai Medical Center and Hospital
Avanashi Road,
COIMBATORE-641 014.

PARENT CONSENT FORM

I Mrs/Mr/Ms. [illegible] parent/guardian of child [illegible], accept to become a participant in the research study: "**Impact of Sensory Integration on sleep disturbance among children with Sensory Processing Disorder".** The researcher has explained me the content of her research in brief, what she needs to interview from, what treatment program she is providing and has answered the questions related to the research to my satisfaction.

Date: 15/06/2017

Signature of the Parent/Guardian

S. Deepa

Signature of the Researcher

PARENT CONSENT FORM

I Mrs/Mr/Ms. REVATHI parent/guardian of child ADHARVA, accept to become a participant in the research study: "**Impact of Sensory Integration on sleep disturbance among children with Sensory Processing Disorder".** The researcher has explained me the content of her research in brief, what she needs to interview from, what treatment program she is providing and has answered the questions related to the research to my satisfaction.

Date: 20/06/2017

Revathi

Signature of the Parent/Guardian

S. Deepa

Signature of the Researcher

PARENT CONSENT FORM

I Mrs/Mr/Ms. BABU parent/guardian of child Sanjay, accept to become a participant in the research study: "**Impact of Sensory Integration on sleep disturbance among children with Sensory Processing Disorder".** The researcher has explained me the content of her research in brief, what she needs to interview from, what treatment program she is providing and has answered the questions related to the research to my satisfaction.

Date: 20/06/2017

Signature of the Parent/Guardian

S. Deepa

Signature of the Researcher

KAUMARAM
PRASHANTHI ACADEMY
(Run by Kaumaram Prashanthi Trust)

Date: 7.9.17

TO WHOMSOEVER IT MAY CONCERN

This is to certify that Miss.S.DEEPA , MOT 2nd Yr, from KMCH college of Occupational Therapy , conducted her study on " *Impact of Sensory Integration For Sleep Disturbance Among Children With Sensory Processing Disorder*" in our organization.

Director

Mrs.Deepa Mohanraj M.sc.Psy.,
Kaumaram Prashanthi Academy
239/2, Chinnavedamppati PO
Saravanampatti Village
Coimbatore - 641 049

Daisy Swapna M.O.T.,
Pediatric Occupational Therapist
Reg. No. : 3256/06

Mobile : 90439 98999

SHRIANO THERAPY CENTRE

TO WHOMSOEVER IT MAY CONCERN

This is to certify that Miss. S. Deepa, MOT 2nd year, from KMCH College of Occupational Therapy, conducted her study on "Impact of Sensory Integration for Sleep Disturbance Among Children with Sensory Processing Disorder" in our centre. She was regular and sincere. We wish her success in future endeavour.

Daisy Swapna M.O.T.,
Paediatric Occupational Therapist

Place - Coimbatore

Date - 7. 9. 2017

SHRIANO THERAPY CENTRE
COIMBATORE

295, Peranaidu Layout, Ramnagar, Coimbatore - 641 009.Email : shrianotherapycentre@gmail.com

MASTER CHART

	age	gender	pre child	post child	pre parents	post parents	pre cshq	post cshq
Epradeep	3.4	1	40	80	40	80	62	39
Emirthik	4	2	40	70	50	70	58	40
Erakshit	3.8	1	50	80	50	90	51	37
Enatraj	4	1	40	90	60	90	59	37
Evishaga	3.1	1	50	70	50	80	57	39
Ejayanth	3.6	1	40	90	50	90	52	35
Eshai	4.6	1	50	80	50	80	50	37
Eshai	3.9	1	50	80	60	90	57	40
Enishant	4.1	1	50	80	50	80	58	36
Esanju	5	2	40	80	60	90	52	39
	age	gender	pre child	post child	pre parents	post parents	pre cshq	post cshq
Csakthi	3.3	2	40	50	40	50	60	47
cnithees h	6.6	1	40	40	50	50	51	51
Crozan	4	1	40	40	40	50	59	69
Cagila	3.7	2	50	50	50	50	53	53
Cpranav	4.6	1	40	50	40	50	55	57
Cdhurva	3.8	1	50	50	50	50	58	58
Csaravan	3.4	1	40	40	50	40	59	52
Cishan	4.1	1	50	50	50	50	55	55
Csashvin	3	1	50	50	40	50	60	55
Cadharva	5.6	1	40	50	50	50	57	55

names	age	gender	pre s1	s2	s3	s4	s5	s6	s7	s8	s9	s10	s11	s12	s13	s14
Epradeep	3.4	1	10	32	48	65	10	46	14	10	10	6	8	8	10	4
Emirthik	4	2	27	33	15	22	23	16	36	35	18	10	7	80	13	5
Erakshit	3.8	1	12	32	21	74	29	40	40	21	25	16	15	80	24	12
Enatraj	4	1	35	10	49	89	34	47	41	26	34	25	9	25	19	10
Evishaga	3.1	1	39	34	12	79	23	46	10	41	29	19	16	63	22	7
Ejayanth	3.6	1	11	26	37	25	28	47	21	50	20	7	15	80	23	12
Eshai	4.6	1	27	43	48	45	29	49	35	15	34	11	11	66	29	12
Eshai	3.9	1	32	26	27	64	12	49	12	50	19	7	16	36	9	8
Enishant	4.1	1	26	28	12	89	18	25	40	37	18	10	12	20	11	12
Esanju	5	2	14	15	20	35	34	40	10	16	25	12	10	63	10	8
names	age	gender	post s1	s2	s3	s4	s5	s6	s7	s8	s9	s10	s11	s12	s13	s14
Epradeep	3.4	1	36	41	53	75	28	59	39	45	23	19	18	64	22	14
Emirthik	4	2	32	41	50	74	31	47	44	49	30	19	16	66	21	11
Erakshit	3.8	1	36	40	49	87	30	58	44	46	30	17	19	65	28	15
Enatraj	4	1	38	32	53	90	35	58	43	48	26	19	15	66	28	15
Evishaga	3.1	1	40	40	49	86	27	58	43	47	30	20	19	69	28	12
Ejayanth	3.6	1	26	36	49	73	32	55	45	50	25	15	19	75	27	15
Eshai	4.6	1	36	44	54	77	44	59	41	43	31	19	18	75	30	14
Eshai	3.9	1	38	32	46	78	23	55	40	47	24	18	19	78	27	14
Enishant	4.1	1	38	32	49	90	27	51	41	45	24	20	19	71	29	15
Esanju	5	2	30	32	42	88	35	45	45	45	25	17	18	70	25	14

names	pre f1	f2	f3	f4	f5	f6	f7	f8	f9
Epradeep	54	53	15	45	27	33	17	10	10
Emirthik	29	57	35	26	10	11	18	12	5
Erakshit	36	79	40	34	27	8	4	5	11
Enatraj	58	37	19	35	25	33	17	13	10
Evishaga	69	58	26	10	21	34	12	12	11
Ejayanth	26	57	40	26	23	33	14	18	10
Eshai	69	20	21	15	20	34	19	19	8
Eshai	39	21	14	38	21	36	16	19	8
Enishant	83	60	39	34	18	11	8	5	10
Esanju	30	40	22	45	10	30	13	13	10
names	post f1	f2	f3	f4	f5	f6	f7	f8	f9
Epradeep	77	72	40	45	31	39	19	16	12
Emirthik	57	70	44	34	27	35	18	16	10
Erakshit	80	75	41	40	30	39	17	14	13
Enatraj	75	66	43	41	30	35	20	17	14
Evishaga	76	67	41	41	29	39	19	16	14
Ejayanth	80	67	39	35	12	39	16	20	13
Eshai	75	66	36	36	27	36	20	15	10
Eshai	80	60	44	44	24	40	19	17	11
Enishant	80	69	41	40	27	35	16	17	15
Esanju	76	73	41	45	30	40	20	17	10
names	pre q1	q2	q3	q4					
Epradeep	69	105	44	45					
Emirthik	58	92	25	117					
Erakshit	16	125	50	116					
Enatraj	69	106	41	67					
Evishaga	45	117	79	77					
Ejayanth	33	115	99	114					
Eshai	58	30	80	111					
Eshai	55	104	73	113					
Enishant	65	58	99	136					
Esanju	25	39	84	116					
names	post q1	q2	q3	q4					
Epradeep	72	120	81	121					
Emirthik	100	120	90	121					
Erakshit	59	129	81	131					
Enatraj	71	121	84	100					
Evishaga	66	122	93	118					
Ejayanth	70	120	95	129					
Eshai	63	97	85	128					
Eshai	68	121	88	126					
Enishant	71	103	86	132					
Esanju	60	101	94	125					

names	age	gender	pre s1	s2	s3	s4	s5	s6	s7	s8	s9	s10	s11	s12	s13	s14
Csakthi	3.3	2	10	35	19	75	10	43	43	47	17	15	16	66	10	10
Csanjay	3.9	1	17	40	46	70	20	15	43	45	27	19	16	55	28	4
Crozan	4	1	28	35	46	77	29	41	44	47	25	15	8	58	17	8
Cagila	3.7	2	37	30	40	20	30	44	37	42	21	19	19	65	20	15
Cpranav	4.6	1	36	43	47	75	30	50	40	45	21	19	13	70	25	14
Cdhurva	3.8	1	35	39	15	79	29	55	35	45	27	19	17	69	25	13
Csaravan	3.4	1	25	39	53	45	9	50	39	50	28	20	20	83	29	13
Cishan	4.1	1	35	28	49	86	10	48	11	45	29	13	17	54	25	10
Csashvin	3	1	28	43	46	29	29	43	44	37	25	19	20	81	26	13
Cadharva	5.6	1	27	44	19	85	10	60	43	45	29	20	17	78	21	13
names	age	gender	post s1	s2	s3	s4	s5	s6	s7	s8	s9	s10	s11	s12	s13	s14
Csakthi	3.3	2	10	35	19	75	10	43	43	47	17	15	16	66	10	10
Csanjay	3.9	1	17	40	46	70	20	15	43	45	27	19	16	55	28	4
Crozan	4	1	28	35	46	77	29	39	44	47	25	15	8	58	17	8
Cagila	3.7	2	37	30	40	20	30	44	16	42	21	19	19	65	20	15
Cpranav	4.6	1	36	43	47	75	30	50	40	45	21	19	13	70	25	14
Cdhurva	3.8	1	28	39	15	79	29	55	35	45	27	19	17	69	25	13
Csaravan	3.4	1	35	39	53	45	9	50	39	47	28	20	20	83	29	13
Cishan	4.1	1	28	33	49	86	10	48	11	45	30	13	17	54	25	10
Csashvin	3	1	26	43	46	29	31	11	44	37	25	19	20	81	26	13
Cadharva	5.6	1	27	44	19	82	32	60	43	45	29	20	17	78	21	13

names	age	gender	pref1	f2	f3	f4	f5	f6	f7	f8	f9
Csakthi	3.3	2	65	48	44	29	13	29	19	16	8
Csanjay	3.9	1	66	73	42	31	31	27	17	10	10
Crozan	4	1	59	73	41	41	21	31	16	13	3
Cagila	3.7	2	71	69	39	39	30	33	9	19	11
Cpranav	4.6	1	80	63	39	33	22	20	16	12	7
Cdhurva	3.8	1	65	60	44	43	27	30	19	14	12
Csaravan	3.4	1	63	79	44	40	25	40	17	18	10
Cishan	4.1	1	80	48	45	11	22	35	14	13	14
Csashvin	3	1	83	60	41	32	30	37	6	15	13
Cadharva	5.6	1	56	56	41	45	11	34	20	18	11

names	age	gender	postf1	f2	f3	f4	f5	f6	f7	f8	f9
Csakthi	3.3	2	65	48	44	29	13	29	19	6	8
Csanjay	3.9	1	66	74	42	31	31	27	17	10	10
Crozan	4	1	59	73	41	41	21	31	16	13	3
Cagila	3.7	2	71	69	39	39	30	33	9	19	11
Cpranav	4.6	1	80	63	39	33	22	20	16	12	7
Cdhurva	3.8	1	65	60	44	43	27	39	19	17	12
Csaravan	3.4	1	63	79	44	40	25	40	17	17	10
Cishan	4.1	1	80	48	45	42	22	35	4	13	14
Csashvin	3	1	83	60	41	32	30	37	6	15	13
Cadharva	5.6	1	56	58	41	45	27	34	20	18	11

names	age	gender	pre q1	q2	q3	q4
Csakthi	3.3	2	64	100	36	133
Csanjay	3.9	1	71	119	79	110
Crozan	4	1	70	57	89	127
Cagila	3.7	2	74	103	92	131
Cpranav	4.6	1	58	121	86	101
Cdhurva	3.8	1	64	113	83	133
Csaravan	3.4	1	69	123	29	129
Cishan	4.1	1	71	101	45	14
Csashvin	3	1	74	124	80	42
Cadharva	5.6	1	69	27	81	133
names	age	gender	post q1	q2	q3	q4
Csakthi	3.3	2	64	100	36	133
Csanjay	3.9	1	7	119	79	110
Crozan	4	1	70	57	89	127
Cagila	3.7	2	74	103	92	131
Cpranav	4.6	1	58	121	86	101
Cdhurva	3.8	1	64	113	83	133
Csaravan	3.4	1	69	123	29	129
Cishan	4.1	1	71	115	45	111
Csashvin	3	1	74	124	80	74
Cadharva	5.6	1	69	27	81	133